COUGAR RESERVOIR WATER TEMPERATURE CONTROL PROJECT
SUPPLEMENTAL BIOLOGICAL ASSESSMENT

U.S. ARMY
PORTLAND DISTRICT CORPS OF ENGINEERS

OCTOBER 1999

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INTRODUCTION

In September 1994, the U.S. Army Corps of Engineers (Corps) submitted a Biological Assessment (BA) to the U.S. Fish and Wildlife Service (USFWS) entitled "Bald Eagles, Northern Spotted Owls, Peregrine Falcons, Oregon Chub and Bull Trout, Willamette Temperature Control Project, Cougar and Blue River Projects." In response, USFWS provided a letter of concurrence dated November 14, 1994 (Ref. 1-7-94-I-515). At the time, bull trout was classified as a Category I Species for listing under the Federal Endangered Species Act (ESA). In their letter, the USFWS indicated that the Corps would need to "conference/formally consult on the impacts to bull trout expected to occur as a result of the proposed project" if bull trout were listed prior to project completion. Bull trout were listed as threatened on July 10, 1998. In addition, the Canada lynx was proposed for listing as threatened on July 8, 1998, by the USFWS, and Upper Willamette River (UWR) spring chinook salmon was listed as threatened on March 16, 1999, by the National Marine Fisheries Service (NMFS). The American peregrine falcon was removed from the Federal List of Endangered and Threatened Wildlife on 25 August, 1999 (64 FR 46542), thereby removing the requirement under Section 7 of the ESA to evaluate impacts to that species.

This supplemental BA is an evaluation of potential effects of construction activities proposed under the Cougar Water Temperature Control (WTC) project (the proposed action) on species listed or proposed for listing under the Federal ESA. The overall purpose of the Cougar WTC project is to address long-standing environmental problems associated with the temperature of discharges below Cougar Dam. Resolution of these problems will greatly benefit spring chinook salmon and bull trout production in the South Fork McKenzie River.

The project area includes the South Fork McKenzie River and the mainstem McKenzie River below its confluence with the South Fork. Flow augmentation provided during summer to the mainstem Willamette River downstream of the McKenzie River will be maintained during implementation of the Cougar WTC project by releases from other storage projects within the Willamette Basin. No other significant effects of the proposed action are likely to occur outside of the McKenzie River Basin.

The USFWS identified the listed and proposed species that may occur within the project area (reference 1-7-99-SP-170), including peregrine falcon, bald eagle, Northern spotted owl, bull trout, UWR steelhead, UWR chinook salmon, and Canada lynx. Because UWR steelhead is not considered to be distributed in the Willamette Basin upstream of the Calapooia River Subbasin (i.e., it does not occur in the McKenzie River Subbasin), it will not be effected by the proposed action. Also, the peregrine falcon is no longer listed. As a result, these species are not addressed in this BA.

The scope of this BA is limited to an assessment of the potential impacts that may occur from construction activities in association with the Cougar WTC project on those species that do (or may) occur in the project area. Potential problems associated with implementation of the Cougar WTC project that might impact fish and wildlife resources and that are, therefore, addressed in this BA include accidental spill of fuel or other pollutants, noise from blasting or operation of construction-related equipment, stranding of fish during reservoir drawdown, bank failure (i.e., landslides) in the reservoir area following drawdown, and lack of adequate water quality due to high water temperature or turbidity in the residual pool or in the South Fork McKenzie River downstream of Cougar Dam.

Long-term operational considerations associated with the Cougar WTC project will be addressed in a separate BA under development for the combined system of thirteen flood control projects operated by the Corps in the Willamette River Basin. Likewise, potential impacts on listed species from construction activities at Blue River Dam or at other water temperature control structure development sites within the Willamette Basin will be addressed under separate, project-specific BA documents.

PROJECT DESCRIPTION

The proposed Cougar WTC project was fully described in the 1995 Feasibility Report and Final EIS document (USACE 1995). Briefly, the proposed project is to modify the Cougar Dam intake structure to provide control of the water temperature of the outflow. A ported, multi-level intake tower will be constructed which will permit control of the level (i.e., depth) at which water is discharged from Cougar Reservoir. This capability will, in turn, permit control of the water temperature of the discharge. If desired, water can be discharged from multiple reservoir levels at the same time to blend waters of different temperatures. Construction will take place during approximately 7 months (April through October) each year for 3 or 4 years (2000 – 2003). In the first year of construction, the diversion works for lowering the pool will be developed. In the following years the pool will be drawn down in the spring to elevation 1,375 feet NGVD[1] and held at this elevation until the fall (approximately June through October) during construction of the intake tower.

[1] NGVD = National Geodetic Vertical Datum.

Several changes have been proposed to this project as a result of further design study. Design changes are discussed in a Feature Design Memorandum (FDM) completed for the project (USACE 1998). Some of these changes will alter the impacts previously described in the Environmental Impact Statement (EIS). Those changes that alter impacts are discussed in a supplemental Environmental Assessment (EA) (USACE 1999). Activities and events associated with project construction that may potentially impact Federal ESA listed or proposed species discussed in the BA are summarized below.

STAGING AREA

> A 250,000-square-foot staging area located at river mile (RM) 2.5 of the South Fork McKenzie River (Strube Flat), will be used for disposal of rock, exit channel sediment, and other construction materials. This was the staging area used when Cougar Dam was originally constructed.

DRAWDOWN

> An unscreened diversion tunnel with a flow capacity of 1,200 cubic feet per second (cfs) at pool elevation 1,375 feet NGVD will be used to draw the lake down and pass inflow during the summer construction period (June through October). Discharge from the reservoir may also be managed by releases through the diversion tunnel during the flood control period (November through May) until the Cougar WTC project is completed (i.e., through 2003). Mortality of fish passing through the diversion tunnel is expected to be high.

> Initial reservoir drawdown will begin in the fall of 2000 and will follow the usual flood control drawdown schedule. Drawdown below normal Minimum Flood Control Pool elevation of 1,532 feet NGVD for construction activities will begin in February 2001, if possible.

> The reservoir will be drawn down to elevation 1,375 feet NGVD during the summer construction period, and a residual reservoir will be maintained at this level. A residual pool at this elevation would have a length of approximately 7,700 feet (1.5 miles), a mean width of 650 feet (0.1 mile), a surface area of about 106 acres, and an approximate volume of 2,845 acre-feet. Mean depth at elevation 1,375 feet NGVD will be approximately 27 feet. Maximum depth at this elevation is 85 feet, which will occur at the entrance to the diversion tunnel. Under inflow events exceeding approximately 1,200 cfs at elevation 1,375 feet NGVD, the residual pool elevation would begin to rise uncontrollably. The need to store a late-season (e.g., June) high flow event, however, could result in storage behind Cougar Dam at inflow levels below 1,200 cfs. At a pool elevation of 1,495 feet NGVD, with a maximum depth of approximately 200 feet, the construction area at the temperature control structure would begin to be inundated. The Corps may stop construction when the risk of inundation becomes too great. However, the Corps may be able to continue construction activities above completed work that has been inundated.

- > Drawdown to residual pool level will normally be completed by the end of May, and the summer construction period for the intake tower will extend from June through October during 2001 through 2003. High flow events either late in the spring or during the early fall may shorten the construction period. Normal flood control operations will resume in November.
- > Summer flow in the South Fork McKenzie River below Cougar Dam would be equal to residual pool inflow and may be reduced from present minimum flows of 300 cfs.
- > During drawdown, releases from other storage projects in the Willamette Basin will be made as needed to meet minimum flow requirements at Albany (5,000 cfs) and Salem (6,500 cfs) during the summer low flow period.

MAIN DIVERSION TUNNEL

- > The diversion tunnel used in the original construction of Cougar Dam will be re-opened to drawdown the lake for construction. Explosives will be used to remove the concrete plug. Blasting would occur from mid-April to mid-June, 2000. A single, final blast to tap the concrete plug would occur in February or March 2001.
- > The downstream portal of the diversion tunnel will be cleaned of trees and shrubs, and the rock slope will be supported as necessary. The exit channel will be rehabilitated, including removing approximately 1,300 cubic yards (cy) of sediment fill materials that have been placed in the channel since the completion of the dam, and placing about 2,600 cy of riprap in areas where the original riprap has been removed or where it is undersized. A rock barrier fence will be constructed just above the break of slope. A crane will be used to lift equipment and remove spoils. Some rock drilling will occur but blasting will not be necessary.
- > In-water disposal will be used to dispose of all lake sediment material moved. An estimated 500 cy of lake sediment and debris will need to be removed from the upstream portal of the existing diversion tunnel.
- > To provide access for continuing maintenance activities in the reservoir regulating outlet area, a permanent road will be built on existing fill that will cross a box culvert located just below the exit of the diversion tunnel before its flow enters the South Fork McKenzie River. No fish will be able to ascend into this area. There will be no effect of this action on water quality or on fish.
- > A 120 foot long cofferdam 12 feet high with an approximate volume of 1,100 cubic feet and a footprint of 5,200 square feet will be located in the tailrace at the lower end of the diversion tunnel during the first year of construction. The cofferdam is needed to de-water the downstream portal of the diversion tunnel and will be removed after the first year of construction. No rock blasting will occur. Heavy equipment (e.g., crane, front-loader, compactor) will be used to transport, place and compact the dam.
- > A new gate chamber will be constructed and flow control gates will be installed in the diversion tunnel. All excavation for the new gate chamber

will occur in the existing diversion tunnel ?700 feet inside (upstream) from the exit portal. Construction will require the excavation of a large room to accommodate the gates and electrical equipment. Approximately 1,500 cy of rock will be excavated. Additional excavation work will include removing approximately 700 cy of rock to transition the tunnel back down to its original dimensions, and removing approximately 110 cy of rock below the invert of the original tunnel to form a rock trap. With the exception of the concrete plug, all tunnel excavation is expected to be performed by drill and blast methods using full face rounds. Approximately 150 cy of rock will be removed with each blast. Twenty rounds will be necessary to excavate the gate room. One blast per day will occur from mid-April to mid-June 2000.

> A by-pass channel, which was cut into the invert of the diversion tunnel to handle the flow during construction of the concrete plug, will be removed. Approximately 1,000 cy of rock will be excavated. Approximately 12 blasts will be needed, with one blast occurring per day, between mid-April and mid-May 2000.

> A 350-foot section of the existing diversion tunnel will be lowered 6 feet by blasting. Approximately 500 cy of rock will be removed. Each blast will remove approximately 80 cy of rock. As many as three blasts per week will occur, with a total of approximately 7 blasts occurring over a 3 to 4 week period (between mid-April and mid-June 2000).

COUGAR RESERVOIR INTAKE STRUCTURE

> All rock slopes in the construction area will be cleaned of loose debris, scaled and supported with rock bolts. A drill rig will be used to drill approximately 315 holes in the existing rock face. A crane will be used to lift equipment and remove spoils.

> A cofferdam will be constructed to provide adequate flood protection during the construction season. The crest of the cofferdam will be at elevation 1,495 feet NGVD. The cofferdam will most likely consist of roller-compacted concrete. The part of the cofferdam above the regulating outlet (RO) bench would be removed at the end of the construction work.

> Approximately 910 cy of rock will be removed from the existing RO bench. Excavation will be by blasting, which will occur from early-April to mid-June 2001. In addition, a thin sliver of rock (40 feet long and 60 feet high) will be removed to make room for a new structural concrete wall to support the new RO trashrack. The volume of rock to be excavated on this slope is approximately 300 cy. Approximately six shots (2 shots per week) will be required to remove a total of 1,210 cy of rock. Blasts will occur mid-day or later as charges must be shot the day they are loaded and can not be left in place overnight.

> The existing trash rack bridge will be demolished and a new one constructed approximately 40 feet upstream. The abutment will be founded on rock. The amount of excavation is expected to be minimal.

The trash rack structure will be demolished using either a hoe ram or cable saw.

> The existing penstock channel will be excavated to the extent necessary to accommodate the new WTC structure. Approximately 500 cy of rock will be excavated by blasting. Approximately three shots (2 shots per week) will be required. Blasting would occur from mid-June to mid-July 2001.

RUSH CREEK DIVERSION TUNNEL

> Access to the intake will be from the trash rack bridge area by constructing a temporary road over part of the embankment into the intake area. A crane will be used to lift equipment and remove spoils.

> A temporary diversion will be constructed at the intake to direct Rush Creek flows. Approximately 500 cy of rock material will be mechanically removed.

> To completely re-mine the Rush Creek shaft, approximately 205 cy of material will need to be removed. One-fourth of the material is expected to be large blocks that will require blasting. Blasting would occur from mid-April to mid-June 2001. A permanent portal structure will be constructed at the intake of this diversion.

As discussed in the EA supplement (USACE 1999), design features initially included in the Feasibility Report and Final EIS (USACE 1995) that have subsequently been dropped because of impracticality include fish screening at the diversion tunnel entrance and extensive erosion control measures throughout the drained reservoir area.

SPECIES AND HABITAT STATUS

UPPER WILLAMETTE RIVER SPRING CHINOOK SALMON

Species/Critical Habitat Description

NMFS defined the Upper Willamette River (UWR) spring chinook salmon evolutionarily significant unit (ESU) based on information provided in the status review of West Coast chinook salmon prepared by Myers et al. (1998). UWR spring chinook includes all spring chinook salmon that are naturally produced in the Willamette Basin in tributaries located above Willamette Falls. The McKenzie River provides one of two primary spawning areas for UWR spring chinook, and is the most productive area for naturally produced spring chinook above Willamette Falls (Willis et al. 1995).

Critical habitat for UWR spring chinook salmon has not yet been designated by NMFS. However, Oregon Department of Fish and Wildlife (ODFW) lists the McKenzie River as essential habitat for spring chinook salmon production in the Willamette Basin (ODFW 1993), and considers the McKenzie to be the most important remaining area for natural production of spring chinook in the Willamette Basin (ODFW 1999).

Life History

Aspects of the life history of UWR spring chinook salmon are discussed in the NMFS status review for West Coast chinook salmon (Myers et al. 1998). Life history characteristics, particularly for spring chinook produced naturally in the McKenzie River, are also summarized in the Willamette Temperature Control Final Environmental Impact Statement (EIS) (USACE 1995) prepared, in part, for the Cougar WTC project.

Adult UWR spring chinook enter the Columbia River in late winter through early spring (i.e., February through April), and enter the lower Willamette River beginning in February. The run peaks in April, with passage through the Willamette River above Willamette Falls occurring primarily from late April through July (Myers et al. 1998; Willis et al. 1995). Spring chinook begin to enter the McKenzie River as early as mid to late April when water temperatures begins to reach 52-54?F. Most of these pre-spawners hold in pools of cool water until spawning time in the fall.

Spring chinook spawning in the McKenzie River formerly began in mid August and lasted as late as the third week of October (Willis et al. 1995). It is now largely confined to September, but may extend into mid October. Spring chinook fry emergence occurred in February through March under natural, historical conditions. Elevated water temperatures during the fall below Cougar Dam in the South Fork McKenzie River, which accelerate embryonic development, have resulted in emergence occurring as early as December.

Naturally produced spring chinook begin to drift into downstream rearing habitat in the lower mainstem McKenzie River or in the upper Willamette River as early as one month after emergence. Life history strategies include rearing in lower tributaries of the McKenzie or in the McKenzie mainstem for from three to 16 months. Three major periods of juvenile emigration occur in the McKenzie. Based on migration patterns averaged over the period 1986-92 from data collected by Eugene Water and Electric Board at Leaburg Dam, fry emigrate to rearing habitat downstream in January through March, shortly after emergence. Subyearling smolts (i.e., ocean-type life history) emigrate primarily in October through December. Yearling smolts emigrate from the McKenzie during their second spring in March and April (Willis et al. 1995).

Samples collected at various locations within the McKenzie Basin between 1948 and 1968 showed that fry migration historically occurred from March through June, several months later than under current conditions of January through March. Likewise, subyearling smolt migrations that now peak in October and November historically occurred in January through March. Howell et al.

(1988) suggested that the change in juvenile migration timing may be due to the release of warm water from impoundments above spawning areas during the fall incubation period, and consequent acceleration of fry emergence and movement. Development of water temperature control capability at Cougar Dam is intended to aid in restoring historic flow temperatures and historically more adapted life history behavioral patterns.

Population Dynamics

The historic annual run size of spring chinook salmon into the McKenzie River (approximately 18,000 fish) and the effects of hatchery programs in the basin prior to completion of Cougar Dam in 1964 and Blue River Dam in 1970 are summarized in the Willamette Temperature Control Final EIS (USACE 1995). The following information focuses on trends in abundance of spring chinook salmon since 1970, when both storage projects were in operation.

Estimates of spring chinook salmon returns to the McKenzie River since 1970 have comprised from 10.9% (1984) to 25.5% (1993) of the estimated escapement of spring chinook over Willamette Falls (Table 1), averaging 5,861 fish (16.7%) from 1970 to 1979, 6,183 fish (13.5%) from 1980 to 1989, and 6,480 fish (17.1%) from 1990 through 1998. Likewise, the average escapement of spawners over Leaburg Dam and into the natural production area in the upper McKenzie River has increased (Table 1). From 1970 to 1979, an average of 2,599 fish escaped over Leaburg Dam. This average is 44% of the estimated total spring chinook run returning to the McKenzie River. Escapement over Leaburg Dam averaged 2,493 fish (40% of total return) during 1980 to 1989 and 2,950 fish (46% of total return) during 1990 through 1998.

Spring chinook redd counts from aerial surveys in the McKenzie River and redd counts from the Carmen-Smith spawning channel located in the upper McKenzie River, both indicate a fluctuating but strong level of natural spawning from the mid 1960's to the present in the McKenzie's primary natural production area located above Leaburg Dam. Adults from Willamette Basin hatcheries comprised an estimated 16% to 46% of the adults passing Leaburg Dam in 1994 through 1998 (Table 1).

The abundance of naturally produced juvenile chinook in the McKenzie River is indexed from migrant trapping at Leaburg Dam. The abundance of smolts in the McKenzie River has been positively correlated with the number of adults above Leaburg Dam that produced them (Figure 1). This correlation appears linear over the full range of observed escapements past Leaburg Dam. There is no indication of a density-dependent reduction in survival, even up to adult escapements of 9,000 salmon above Leaburg Dam (Cramer et al. 1996). This suggests that escapement of spawners, rather than spawning or rearing habitat capacity, is more likely limiting spring chinook production in the McKenzie Basin under current conditions.

Table 1. Estimated return of spring chinook to the McKenzie River and escapement above Leaburg Dam (ODFW, Springfield).

Run Year	Total Return	% Run over Willam. Falls	Leaburg Dam Count	% Wild over Leaburg
1970	4,787	14.0%	2,991	
1971	6,323	14.2%	3,602	
1972	3,770	14.4%	1,547	
1973	7,938	18.9%	3,870	
1974	7,840	17.6%	3,717	
1975	3,392	17.8%	1,374	
1976	4,275	19.3%	1,899	
1977	9,127	22.8%	2,714	
1978	8,142	17.1%	3,058	
1979	3,018	11.3%	1,219	
Mean 1970-79	**5,861**	**16.7%**	**2,599**	**-------**
1980	4,154	15.4%	1,980	
1981	3,624	12.0%	1,078	
1982	5,413	11.7%	2,241	
1983	3,377	11.0%	1,561	
1984	4,739	10.9%	1,000	
1985	4,930	14.3%	825	
1986	5,567	14.2%	2,061	
1987	7,370	13.4%	3,455	
1988	12,637	17.9%	6,753	
1989	10,020	14.5%	3,976	
Mean 1980-89	**6,183**	**13.5%**	**2,493**	**-------**
1990	12,743	17.9%	7,115	
1991	11,553	22.0%	4,359	
1992	8,976	21.4%	3,816	
1993	8,148	25.5%	3,617	
1994	2,992	11.5%	1,526	54%
1995	3,162	15.4%	1,622	57%
1996	3,640	16.8%	1,445	76%
1997	3,110	11.6%	1,176	84%
1998	3,997	11.6%	1,874	77%
Mean 1990-98	**6,480**	**17.1%**	**2,950**	**-------**

Sedell et al. (1992) found that both the quantity and quality of spawning habitat in the upper McKenzie Basin is good and has not changed substantially from historical conditions. As discussed in our Final EIS, available spawning gravel has far exceeded the abundance of spawners. Less than 1% of available spawning gravel was used during the period 1965 through 1991 (USACE 1995). This is not unusual in that most biologists agree that rearing or over-wintering habitat is more often limiting than spawning habitat to productivity in fully seeded salmon habitat in the Pacific Northwest. However, neither spawning nor rearing habitat appear to be currently limiting spring chinook productivity in the McKenzie Basin.

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Figure 1. Relationship between the number of spring chinook smolts passing Leaburg Dam on the McKenzie River and the number of adult spawners in the parent run passing upstream of Leaburg Dam. From K. Homolka, ODFW, Springfield, after Cramer et al. 1996.

Status and Distribution

Hatchery spring chinook salmon were introduced into the South Fork McKenzie River above Cougar Reservoir by ODFW in 1996 to develop a land-locked, harvestable population in the reservoir. The offspring of some of these fish presently inhabit the reservoir. This population is not a part of the Upper Willamette spring chinook salmon ESU listed under the Federal ESA.

Population dynamics for naturally spawning spring chinook salmon in the McKenzie Basin, as discussed above, suggest that spawner abundance has slowly increased over the period 1970 to the present. The abundance of naturally produced spring chinook spawners above Leaburg Dam averaged approximately 1,056 fish from 1994 through 1998. Likewise, the production of juveniles has increased linearly in relation to spawner abundance.

In their current (January 1, 1999) assessment of stock status, ODFW stated that “Although heavily influenced by hatchery fish, the wild population of spring chinook in the McKenzie River is the most productive in the Willamette gene conservation group.” “… fish still have access to relatively undisturbed spawning and rearing habitat … capable of producing at least several thousand wild adults, despite habitat alterations …” “Current adult escapement is believed to be much less than the number required to fully seed the habitat.”

Distribution of spawning above Leaburg Dam was discussed in the Final EIS (USACE 1995). Approximately 30% of the spawning distribution occurs in the mainstem McKenzie River below the confluence with the South Fork, 60% of spawning occurs in headwater areas above the confluence with the South Fork, and 10% of the current spawning distribution occurs in the South Fork of the McKenzie River.

Main stem areas of subbasins where spring chinook reproduce naturally in the Willamette Basin are very important for rearing habitat, and the upper main-stem Willamette River may also be important for rearing (Willis et al. 1995). Murtagh et al. (1992) notes that juvenile spring chinook in the Clackamas River do not appear to use the tributaries as rearing areas. Studies by Everest et al. (1987) in Fish Creek, as an example, showed that most fry emigrate to the Clackamas River soon after emergence. Zakel and Reed (1984) observed the same type of behavior among spring chinook juveniles in the McKenzie River.

Life History Stages Likely to be Affected

Both adult and juvenile life history stages of spring chinook salmon may potential be affected by change in flows, water temperature, and water quality (i.e., turbidity) conditions that are likely to occur as a result of Cougar WTC project construction activities.

BULL TROUT

Species/Critical Habitat Description

The USFWS has identified three subpopulations of bull trout within the Willamette River Basin, all of which occur in the McKenzie River Subbasin. These include the lower McKenzie River, McKenzie River, and South Fork McKenzie River subpopulations.

Bull trout exhibit resident and migratory life history strategies. These life-history forms may be found together, and it is suspected that bull trout give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). However, only the migratory life history form has been documented in the McKenzie River Basin. Both river- (fluvial) and lake-dwelling (adfluvial) migratory life history patterns occur in the basin. Buchanan et al. (1997) observed that fluvial populations can become adfluvial populations under some circumstances, such as the isolation of populations above dams. Both fluvial and adfluvial life history strategies can occur within the same population.

Bull trout have been observed to have more specific habitat requirements than do other salmonid species (Rieman and McIntyre 1993). Habitat components that influence bull trout abundance and distribution include water temperature, shelter, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (63 FR 31647). They are found primarily in cold streams. Water temperature above 59?F is likely to limit bull trout distribution (Fraley and Shepard 1989). Goetz (1989) suggested optimum water temperatures for rearing of 44-46?F. Spawning areas are often associated with cold-water springs and groundwater infiltration (Pratt 1992; Rieman and McIntyre 1993). Preferred spawning habitat consists of low gradient streams with loose, clean gravel (Fraley and Shepard 1989) and with water temperatures in the range of 41-48?F. Optimum temperatures for egg incubation are 35-39?F (Goetz 1989).

Complex forms of cover are important to all life history stages of bull trout. These include the occurrence of large woody debris (LWD), undercut stream banks, boulders, and pools (63 FR 31647). Suitable winter habitat may be more limiting to bull trout productivity in many areas than summer rearing habitat. Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (63 FR 31647). Juvenile bull trout in four central Washington streams occupied areas where the flow rate was less that 1.6 feet/second over a variety of substrates ranging from sand to boulders (63 FR 31647).

Although critical habitat for bull trout has not yet been designated by the USFWS, “the present or threatened destruction, modification, or curtailment of bull trout habitat” was identified by USFWS as one of the principle factors affecting the species (63 FR 31647). The three subpopulations of bull trout identified by USFWS that occur in the McKenzie River Basin constitute the last remaining population group in Oregon west of the Cascade Mountain Range. All of the occupied habitat in the McKenzie Basin is obviously critical to the persistence of this population group.

Life History

Both fluvial and adfluvial life history forms of bull trout occur in the McKenzie River Basin, and in the South Fork McKenzie River (SFMR) subpopulation located above Cougar Reservoir. The specific behavioral characteristics of the SFMR subpopulation are not presently well understood. The Corps is currently helping to fund a cooperative research effort among the USFWS, USFS, and ODFW to acquire better information about this particular subpopulation. Research funded by the Corps in 2000 will focus in part on behavior and movement of bull trout between the reservoir and its primary tributaries. Research will also focus on identification of techniques for safely capturing, handling, transporting, and holding bull trout (see “Monitoring” below).

Bull trout populations are known to exhibit multiple, complex life history traits including multiple life history forms, complex age structures, and complex maturation schedules (Rieman and McIntyre 1993). They may reach sexual maturity at an age of from four to nine years (Williams and Mullan 1992; Pratt 1992). They typically live 10 to 12 years (Scott and Crossman 1973), but may live as long as 20 years (Carlander 1953). Males often mature a year earlier than females (Scott and Crossman 1973). Repeat and alternate year spawning has been reported. Repeat spawning frequency and post-spawning mortality rates are not well documented (63 FR 31647).

Bull trout typically spawn from August through November during periods of decreasing water temperature and during daylight hours (Scott and Crossman 1973). Migratory bull trout have been observed to frequently begin spawning migrations as early as April (Fraley and Shepard 1989), but spawning migrations usually occur in August and September (Scott and Crossman 1973). Populations occurring in rivers and lakes have been observed to spawn at about the same time (Scott and Crossman 1973). Mature bull trout have been observed migrating from Cougar Reservoir into headwater spawning areas above the reservoir during April and May (Jeff Ziller, ODFW Springfield, personal communication).

Juvenile migratory bull trout can spend from several months to several years in natal stream areas before emigrating into larger rivers or lakes (Scott and Crossman 1973). Juvenile migrations from natal areas may occur during spring, summer, or fall (Pratt 1992). Most migration activity occurs at night (Ratliff et al. 1996). Migratory corridors link seasonally important habitats for all bull trout life history forms (Fraley and Shepard 1989). The ability to migrate, forming population networks or metapopulations, is important to the persistence of local bull trout subpopulations (Rieman and McIntyre 1993).

Little is known regarding the specific migratory behavior of juvenile bull trout produced in headwater areas of the SFMR (primarily in the Roaring River) above Cougar Reservoir. Research funded by the Corps during 2000 will provide additional information concerning their behavior prior to initiation of reservoir drawdown and construction activities in 2001.

Population Dynamics

Based on an increasing trend in redd counts in Anderson Creek (ODFW 1999), the lower McKenzie River subpopulation appears to be stable or increasing. The current dynamics of the other two subpopulations located above Trailbridge Dam and Cougar Dam, respectively, are unknown. The Corps is helping to fund research investigations in an effort to learn more about the SFMR subpopulation located above Cougar Dam.

Status and Distribution

The lower McKenzie River bull trout subpopulation is distributed in the McKenzie River and its tributaries from the mouth (but primarily from above Leaburg Dam) upstream to Trailbridge Dam on the mainstem and to Cougar Dam on the South Fork. The McKenzie River subpopulation is distributed in the McKenzie River and its tributaries above Trailbridge Dam up to Tamolitch Falls, a natural barrier (Buchanan et al. 1997). This subpopulation is currently isolated from the other two subpopulations by Trailbridge Dam. The SFMR subpopulation is distributed in the South Fork McKenzie River and its tributaries above Cougar Dam, and is currently isolated from the other to subpopulations by the dam.

The abundance of mature bull trout in the entire McKenzie River Basin has been estimated at less than 300 individuals (63 FR 31647). The lower McKenzie River subpopulation is the most robust of the three subpopulations. Spawning activity has been documented in Anderson and Olallie creeks, with an estimated average annual production of approximately 22,000 fry from 1997 through 1999. In addition, juvenile trapping by ODFW resulted in an average expanded catch of 289 yearling and older fish occurring in Anderson Creek over the period 1994 through 1998 (ODFW 1999). Based on an increasing trend in redd counts, large numbers of juvenile fish, an increase in the availability and use of spawning habitat in Olallie Creek, and the potential for re-connecting the basin's three subpopulations, the USFWS does not consider the lower McKenzie subpopulation to be at high risk of extinction.

Relatively few bull trout occur in the SFMR below Cougar Dam. However, ODFW has stated that anglers catch bull trout in the SFMR on a fairly regular basis (Jeff Ziller, ODFW Springfield, personal communication). While spawning does not occur in this area, rearing of adult and subadult fish (age 2-3) does occur.

The McKenzie River subpopulation above Trailbridge Dam is considered by USFWS to be at high risk of extinction due to isolation, suspected low population abundance, lack of documented spawning activity, and paucity of available spawning habitat.

Spawning activity in the SFMR subpopulation has been documented in the Roaring River (Buchanan et al. 1997). Redd counts have been extremely low. ODFW reported observing 36 spawners during the fall of 1999 in the Roaring River. The USFWS considers the SFMR subpopulation to be at high risk of extinction because of isolation, low abundance, and limited spawning habitat.

Life History Stages Likely to be Affected

Potential impacts may occur to all life history stages of bull trout located above and below Cougar Dam in the South Fork McKenzie River. Bull trout located below the confluence of the SFMR with the mainstem McKenzie River are unlikely to be effected by the proposed action.

BALD EAGLE

Species and Habitat Description

Bald eagles inhabit the forests of Oregon during both the wintering and nesting seasons. They are most abundant during the winter when there is an influx of birds from the north, but there are substantial spring and summer nesting populations. Bald eagles prefer to nest in areas that are primarily mature or old-growth timber near available fish sources, such as lakes, reservoirs, and rivers. Territory shape and size varies with terrain, vegetation, and food availability. Nesting pairs typically forage over an area between 1.0 and 1.25 miles. Foraging areas in winter can be much larger.

In winter, bald eagles congregate near sources of food, generally rivers, lakes and the marine shoreline. Wintering bald eagles depend on suitable night and severe weather roosts in sheltered timber stands. Migrant eagles begin to appear on traditional wintering grounds during late October. Peak numbers occur during January and February.

Life History Stages Likely to be Affected

Bald eagles are not known to nest in the project vicinity but are occasionally observed foraging at Cougar Reservoir. Fish are an important prey item for eagles in the Upper McKenzie River Basin. Bald eagle use at Cougar Reservoir is largely determined by the availability of fish, although areas of high human disturbance may be avoided. High levels of human disturbance can disrupt feeding behavior, restrict habitat use, and cause bald eagles to expend additional energy in flight.

NORTHERN SPOTTED OWL

Species and Habitat Description

Habitats selected by Northern spotted owls typically exhibit moderate to high canopy closure (60 to 80 percent closure); a multi-layered, multi-species canopy dominated by large overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and debris accumulations); large accumulations of fallen trees and other debris; and sufficient open space below the canopy for owls to fly (Thomas, et al. 1990). These attributes are usually found in old growth, but they are sometimes found in younger forests, especially those that contain remnant large trees or patches of large trees from earlier stands. Dispersal habitat includes stands that have at least an 11 inch average tree diameter and at least 40 percent canopy closure (Thomas et al. 1990).

Spotted owl pairs occupy the same territories year after year as long as suitable habitat is present. However, nesting may not occur every year, and survival of offspring varies annually and geographically. Nest trees are often used more than one year, but occasionally a pair will switch to a new nest tree within their home range. Spotted owls begin their annual breeding cycle in late winter (late-February to early-March) when the pair begins to roost together (Thomas et al. 1990). One to three eggs, usually two, are laid in March or April. Incubation lasts for approximately 30 days, and juvenile owls leave the nest 3 to 5 weeks after hatching. Many abandon the nest site well before they are able to fly. The young are fed by both parents until August or September. The young become independent in September or October, at which time they disperse from the parental nest areas.

Life History Stages Likely to be Affected

Noise from construction and blasting activities could disrupt spotted owl behavior. Loud, frequent noise in close proximity to a nest during the period of incubation and nestling development could result in reproductive failure.

CANADA LYNX

Species and Habitat Description

Canada lynx habitat in the Cascade Mountains consists of coniferous forests of mixed age and structural classes. Early successional forest stages provide habitat for the lynx's primary winter prey, the snowshoe hare. Mature forests with downed logs and windfalls provide cover for denning sites, escape, and protection from severe weather. A key component of lynx habitat is dense understory vegetation. The species makes extensive use of riparian vegetation, particularly areas with dense, shrubby willow and alder stands.

Lynx breed in late winter (Ingles 1965). After a gestation period of at least 60-days, one to four young are born, usually in March or April. Young are weaned in about 2 months.

The home range of a lynx can be up to 100 square miles. They are capable of moving extremely long distances in search of food. In the Cascade Mountains, Canada lynx exhibit seasonal elevation movements (Camryn Lee, USFWS, pers. com. June 28, 1999), possibly in response to prey availability. The species occupies lower elevations (below 5,000 feet) in winter, particularly during periods of heavy snow cover. In spring, as the snow melts, lynx move to higher elevations.

Life History Stages Likely to be Affected

The South Fork McKenzie River watershed provides suitable foraging habitat for lynx. Specifically, early successional forest cover in the project vicinity may provide winter prey habitat. Denning is not likely to occur at the project elevation. Lynx summer at higher elevations (i.e., above 5,000 feet) than are found in the project area.

ENVIRONMENTAL BASELINE

CURRENT STATUS OF SPECIES

Upper Willamette River Spring Chinook Salmon

Access of spring chinook salmon to former spawning areas located above Cougar Dam has been blocked to natural migration since the dam was completed in 1963. When early attempts at passing adult and juvenile spring chinook around Cougar Dam and Reservoir failed, the Corps mitigated the associated lost natural production through cooperative funding of artificial production programs within the Willamette Basin. In recent years (i.e., 1993 and 1996-98), ODFW released adult hatchery spring chinook spawners into habitat above Cougar Reservoir to achieve three objectives:

> provide food for bull trout,
> change the dynamics of nutrients in the upper watershed of the South Fork McKenzie River, and
> develop a landlocked chinook salmon fishery in Cougar Reservoir.

Pre-spawner abundance and survival in the South Fork McKenzie River below Cougar Dam are currently much lower than in other natural production areas within the McKenzie River Basin, as discussed above. Unnaturally cold water temperatures during the summer below Cougar Dam limit recruitment of pre-spawners into the South Fork and create unfavorable growing conditions and poor survival for rearing juveniles. Unnaturally warm water temperatures during the fall result in early emergence and poor survival of spring chinook fry.

Bull Trout

Bull trout in the SFMR subpopulation located above Cougar Dam have been isolated from the other two McKenzie River subpopulations located below Cougar Dam or outside of the South Fork McKenzie River watershed since Cougar Dam was completed in 1963. Bull trout are known to occur in Cougar Reservoir and have been caught by anglers both in and above the reservoir since its completion. The abundance of bull trout in Cougar Reservoir is unknown, but was estimated at between 100 and 500 fish by ODFW (USACE 1995). The abundance of bull trout in the watershed above Cougar Reservoir is currently extremely low. Small numbers of bull trout also occur in the South Fork McKenzie River below Cougar Dam. Spawning does not occur in this area, but rearing of adult and subadult (age 2-3) bull trout does occur there.

Relatively cold water temperatures occurring in the summer, which result in poor growth and survival of juvenile spring chinook salmon as discussed above, also reduce the availability of food for bull trout, which historically fed on juvenile spring chinook. Under existing conditions, the abundance and distribution of bull trout in the area below Cougar Dam is not expected to change.

Bald Eagle

The Corps reviewed Isaacs and Anthony (1998) to determine if nesting bald eagles occur in the vicinity of Cougar Reservoir. The nearest nest site is at

Blue River Reservoir, approximately 5 miles distant from the Cougar Dam. Records of the Midwinter Eagle Counts (Issacs 1994, 1997, 1998) indicate minimal occurrence by wintering bald eagles in the McKenzie River drainage. One wintering bald eagle was recorded along the upper McKenzie River in 1989, 1994 and 1998; no eagles were reported for other years for the count period of 1988 through 1998.

Northern Spotted Owl

Three spotted owl activity areas were described in the 1994 BA (USACE 1995). Two of these sites were located more than a mile from Cougar Dam, and the third site was in the Rush Creek watershed, approximately 0.75 mile from the project area. Although spotted owl pairs have been observed in the Rush Creek watershed almost every year since 1984, nesting was not confirmed in most years that surveys were completed (R. Seitz, pers. comm. 23 August 1999). Moreover, the activity area moved, apparently in response to logging operations in the upper watershed (? 50% of the watershed has been logged).

A fourth spotted owl activity area was established in the Rush Creek watershed in 1998 (R. Seitz, pers. comm. 23 August 1999). Nesting was confirmed at this site in 1998 but not in 1999. The nest was located adjacent to a gated Forest Service Road, at elevation 1,960 feet, approximately 2,000 feet from the Rush Creek diversion tunnel intake. Spotted owl pairs have been observed south of this location in previous years.

Canada Lynx

There have been several detections of Canada lynx in the project vicinity (Ms. Camryn Lee, USFWS, pers. comm., June 28, 1999). A hair sample collected in September 1998 at a scent station on the Sweet Home Ranger District at elevation 4,200 feet was confirmed to be Canada lynx. While there have been observations of Canada lynx and lynx tracks nearer to the project site, none of these observations were confirmed. An unconfirmed observation of a lynx in the H.J. Andrews Experimental Forest approximately 6 miles north of Cougar Dam was recorded in August 1994. Lynx tracks were found but not confirmed in winter (March) in the Cougar Creek drainage near Castle Rock, approximately 2.5 miles northeast of Cougar Dam, and in the Penny Creek drainage, approximately 5.5 miles south of Cougar Dam, in 1994 and 1993, respectively.

FACTORS AFFECTING THE ENVIRONMENT

Cougar Dam and Reservoir is operated to provide flood control in the Willamette Basin below the dam. In general, the reservoir is held at low elevation from November through February of each year, to the extent possible depending upon discharge conditions above the dam and within the McKenzie and Willamette river basins.

Water storage begins in March and is completed in April or May, depending upon discharge levels above the dam and within the McKenzie and Willamette river basins. The Reservoir is filled with cold water during this late winter and spring period. Discharges below the dam are similar to natural (i.e., pre-impoundment) conditions during most of this period. Summer thermal stratification of the reservoir, coupled with deep water releases from the hypolimnion, result in unnaturally cold flows below Cougar Dam during the late spring and summer (May through August), and in the retention of warm water in the reservoir's epilimnion. The summer high reservoir elevation is maintained through August or September, then the reservoir is drafted until November to prepare for the flood control season. By September, cold water in the hypolimnion has been depleted and flows below the dam become warmer than natural flows would be during the fall and early winter months (USACE 1995).

Reservoir shoreline slopes are steep with relatively little flat land adjacent to the water. Annual drawdown for flood control coupled with operation at full pool during summer has precluded riparian development along the periphery of Cougar Reservoir. Lowering of the pool has exposed denuded rock areas and banks of gravel and mud. The lack of riparian habitat limits the presence of aquatic furbearers, amphibians, and birds normally associated with lakeshore areas.

Recreational use at Cougar Reservoir is substantial enough to decrease its value for certain species of wildlife. It has several day-use and camping facilities. Between 1985 and 1989, Cougar Reservoir received an annual average of about 60,000 visitors, ranking it 12th in popularity among the 13 Willamette reservoirs managed by the Corps. Aufderheide Drive, a National Scenic Byway, parallels the South and North Forks of the McKenzie River, forming a loop drive to Oak Ridge where it connects with State Route 58. Daily use from March to May 1994 averaged 307 vehicles during weekdays and 419 vehicles during weekends. Use on July and August weekends in 1993 exceeded 850 vehicles daily (USACE 1995).

Current environmental conditions downstream of Cougar Dam during June through October (i.e., the proposed annual reservoir drawdown and construction period) include:

- regulated discharge with a minimum flow of 300 cfs during the summer low flow period,
- unnaturally cold temperature of water discharged below the dam during late spring and summer that has resulted in habitat use avoidance by adult and juvenile fishes, and in low productivity of organisms used as food by rearing juvenile spring chinook and by juvenile and adult bull trout, and

- unnaturally warm temperature of water discharged below the dam during the fall and early winter that has resulted in accelerated embryonic development and early emergence of spring chinook salmon fry coupled with low survival.

EFFECTS OF PROPOSED CONSTRUCTION ACTIVITIES

SUMMARY OF FACTORS CONSIDERED

Environmental conditions in Cougar Reservoir that would be temporarily altered during drawdown from February through May and during the subsequent construction period from June through October include:

- Increase in potential for accidental spills of fuel or other pollutants in the construction area near the dam,
- increased noise levels due to blasting and operation of construction-related equipment in the construction area near the dam,
- increase in amount and duration of exposed pool substrate,
- reduction in the size of the reservoir to a residual pool at elevation 1,375 feet NGVD with a volume of 2,845 acre-feet, a maximum depth of 85 feet located at the diversion tunnel intake, a mean depth of approximately 27 feet, a surface area of about 106 acres, a length of approximately 7,700 feet (1.5 miles), and a mean width of 650 feet (0.1 mile),
- discharge of up to 1,200 cfs at a pool elevation of 1,375 feet NGVD through an unscreened diversion tunnel, and
- change in temperature and in turbidity over the summer within the residual pool.

Environmental conditions downstream of Cougar Dam that would be temporarily altered from current conditions during periods of reservoir drawdown for construction activities include:

- the occurrence of natural, ambient stream flows (i.e., discharge equal to residual pool inflow) up to 1,200 cfs at a pool elevation of 1,375 feet NGVD except during periods of flood storage,
- more natural, ambient water temperature conditions (i.e., discharge 3-6F? warmer than inflow in summer and the same as inflow in spring and fall), and
- periods of increase in turbidity associated with initial drawdown and with subsequent irregular natural runoff events.

The Corps's Hazardous, Toxic, and Radioactive Waste (HTRW) investigation at the proposed staging area (Strube Flats) indicated that it was free of contaminants at concentrations above Oregon standards except for levels of arsenic, but detected levels were slightly (1-2 parts per million, or ppm) above the standard for industrial sites (USACE 1995). Construction specifications for the

Cougar WTC project would include provisions for pollution prevention and cleanup, the removal of all equipment and supplies from construction sites upon completion of work, and the restoration of the staging area. In addition, specifications would prohibit the contractor from performing any excavation in the staging area. Biological monitoring, as described under the monitoring plan below, would be designed to detect impacts to fisheries resources that might occur as a result of accidental spills of fuel or other pollutants so that corrective action could be taken.

Noise will be emitted during project actions such as construction of access roads and coffer dams, demolition of the intake structure and trash racks, rock drilling to stabilize slopes and place dynamite, and excavation of rock by blasting and mechanical means. The potential direct effects of noise on wildlife can include fright/flight behavior, agitation, stress, avoidance of foraging or other important behavior including abandonment of nest or den sites. Noise generated from equipment of the type to be used during general construction activities would range from 68 to 97 dBA[2] at 50 feet (Western Highway Institute 1971). Under most circumstances, more than one piece of equipment will be operating simultaneously. Consequently, noise from construction is expected to be greater than that emitted by the single loudest piece of equipment. If all of the equipment were operated at the same time and location, the expected noise level generated at the site would be about 100 dBA at 50 feet.

It is difficult to predict the noise level expected from rock blasting. A considerable number of variables interact to influence the noise level, including type of rock, type of explosive, depth and weight of charge, depth of burden, amount of stemming, detonation system and sequencing, and atmospheric conditions. Measures of sound pressure level are generally given using an A-weighted scale, which approximates human hearing. Noise from a rock blasting airblast is characterized as having considerable low-frequency energy, which would be filtered out with A-weighting. Consequently, it is more appropriate to use dB, or “flat weighting” (Siskind and Summers 1974). Siskind and Summers (1974) provide measurements from blasts at quarry, surface mining or excavation activities which indicate that the expected blasting noise would probably be in the range of 90 to 130 dBC (C-peak) at 50 feet. Noise Control Regulations for Industry and Commerce (OAR 340-35-035), established by Oregon Department of Environmental Quality (DEQ), specify noise limitations based on dBC (slow response). Between 10:00 p.m. and 7:00 a.m., noise from blasting shall not exceed 93 dBC (slow response) at noise sensitive properties, such as residential dwellings, libraries, or hospitals. The daytime limit is 98 dBC (slow response).

Summer flows in the South Fork McKenzie River below Cougar Dam would occasionally be reduced to less than current minimum flows of 300 cfs. Although some desiccation of riparian and wetland vegetation may occur, low flows in

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[2] dBA = Decibels on the A-weighted scale.

summer mimic natural stream conditions, and exposed areas should be quickly colonized by annual plants. Riparian vegetation is expected to re-colonize stream banks following construction.

Vegetation at the construction laydown/material storage site located at Strube Flat (elevation 1,200 feet), near RM 2 of the South Fork McKenzie River, would be trampled or cleared. This includes grasses, shrubs and possibly some trees. About 8 acres would be affected. The site was used for laydown/materials storage purposes during original construction of the dam. Successional development of vegetation at the site has been slow, indicative of poor soil development and continued human disturbance.

Turbidity below the dam may increase by as much as ten-fold above current average conditions upon initial drawdown of the reservoir in response to erosion of fine sediments deposited during inundation of the natural stream channel within the reservoir. Turbidity levels sampled in 1992 and in 1994 showed a range of 0.6 to 2.9 Nephelometric Turbidity Units (NTUs) (USACE 1995). Sediment accumulation in Cougar Reservoir has been estimated at from 926 acre-feet to 1,872 acre-feet of material. Most of this material has been deposited in the upper end of the reservoir or just below the discharge of the East Fork McKenzie River into the reservoir. The duration of the initial erosion event is unknown and depends on the location, amount and type of fine sediments that have been deposited in the reservoir; on the retention of sediments within the residual pool; and on the levels of flow that occur following drawdown (i.e., during June through October). Flows during this summer period are normally low.

ANALYSIS OF EFFECTS

Upper Willamette River Spring Chinook Salmon

<u>Instream Flows</u>

Natural stream flow volume, similar to conditions occurring prior to construction and operation of Cougar Dam, will occur below the dam during reservoir drawdown for WTC project construction activities (approximately June through October), unless there is a need to implement flood management procedures. The occurrence of flood level flows from mid June through October is unlikely. Normally, inflows to Cougar Reservoir range between approximately 50 and 1,000 cfs during this time period (Table 2).

Table 2. Mean daily and monthly unregulated flows (cfs) into Cougar Reservoir based on 48 years of record (1947-1995) on the South Fork McKenzie River (RM3.9) near Rainbow, Oregon (USGS Gage No. 14159500).

Month	**Minimum Mean Daily Inflow**		**Mean Monthly Inflow**	**Maximum Mean Daily Inflow**	
	Occurrence	**Mean**		**Mean**	**Occurrence**
January	100	472	1,238	4,313	13,600
February	200	558	1,247	3,704	12,400
March	100	569	1,082	2,353	8,900
April	300	300	1,190	2,260	7,600
May	200	718	1,174	1,937	6,800
June	100	409	748	1,485	7,000
July	100	230	320	496	1,090
August	80	179	221	296	600
September	50	53	206	396	1,400
October	40	165	319	1,099	9,160
November	70	267	819	3,143	10,600
December	100	486	1,263	4,657	22,700

There will be times during August and September in average to low flow years when discharge below Cougar Dam falls below current minimum levels of 300 cfs. Modeling results indicated that flows below 300 cfs during the construction period are likely to occur from five to eight times annually (USACE 1995).

The primary potential impact of changes in flow below Cougar Dam on spring chinook salmon productivity would be with regard to changes in habitat quantity available for adult pre-spawner holding in the South Fork. The quantity of juvenile rearing habitat in the South Fork might also be affected, but juvenile abundance is less likely to currently be limiting to spring chinook productivity in the McKenzie Basin than pre-spawner abundance.

Since approximately ten percent of the spring chinook spawning distribution currently occurs in the South Fork McKenzie River, it is approximately this proportion of the population for which habitat quantity might be impacted by low flows in the South Fork. However, habitat quantity and quality is not currently limiting spring chinook salmon productivity in the McKenzie Basin and pre-spawners in the South Fork have ready access to other areas within the basin. As a result, occasional low flows during construction are not anticipated to have any significant impact on overall spring chinook productivity.

Summer flows in the mainstem McKenzie River at Vida would be reduced by about 5% to 20% during construction in average to low flow years (USACE 1995). The Corps's goal is to provide at least 2,500 cfs in the McKenzie as measured at Vida, though we have no requirement to do so and flows often drop below this level under current operating conditions. During construction, flows will likely drop below 2,500 cfs more often in average to low flow years. Current summer flow augmentation requirements of 5,000 cfs at Albany and 6,500 cfs at Salem can be met at all times unless the Willamette Basin experiences extreme drought conditions with record low flows (USACE 1995). As a result of these conditions, the Corps anticipates no significant change in migration rate or quantity of holding habitat for pre-spawners in areas outside of the South Fork McKenzie River.

<u>Water Temperature</u>

Although flow volume in the South Fork and mainstem McKenzie River may be reduced somewhat in average to low flow years, stream temperatures during summer migration and fall spawning periods will be improved and more natural (i.e., warmer in summer and cooler in fall) than current environmental conditions under all flow conditions occurring during construction activities.

The Final EIS (USACE 1995) discusses effects on water temperature resulting from loss of riparian cover through the reservoir area under drawdown conditions. Flow and temperature modeling indicated that flows released from the residual pool above the dam would average approximately 58? to 63?F daily (only 3-6F? warmer than inflow temperatures) during the hottest summer month (i.e., August).

Pre-spawner mortality rates in the McKenzie Basin have been estimated at 5% above the South Fork, 23% in the South Fork, and 18% downstream of the South Fork (USACE 1995). Improved, more natural, summer water temperatures in the South Fork during the construction period are anticipated to result in increased pre-spawner survival rates that more closely approximate survival rates observed elsewhere in the McKenzie Basin.

Turbidity

The Corps examined the potential sediment supply that might be redistributed downstream during the four-year construction period. Under drawdown conditions, sediment would originate primarily from deposits in the upper end of Cougar Reservoir along with the normal annual sediment loads from the South Fork and East Fork of the McKenzie River.

Drawdown of the reservoir could result in increased risk of a bank failure (i.e., landslide) within the exposed reservoir area that might contribute to the annual sediment load, depending on the location, composition and extent (i.e., sediment volume) of the slide. The rate of reservoir drawdown would be limited to no more than 3 feet per day to minimize the risk of a bank failure. Monitoring of activities, events, and water quality within the project area, as described under the Monitoring Plan below, would be performed to detect the occurrence of a bank failure and its effect on water quality, if it should occur. Once a water quality problem (or potential problem) was detected, the Corps would identify and pursue any reasonable and prudent remedial action that could be taken. An example of such an action might be the use of a silt fence or log boom to reduce erosion and subsequent sedimentation or to curb turbidity.

Most transport of sediment would occur in winter or spring (November through May) during high-flow events. Typically, flows peak in December with a mean monthly flow of around 1,300 cfs (Table 2). A flow level of 2,000 cfs was used to perform the Corps's sediment transport analysis. Actual summer inflow to the residual pool would most likely range between approximately 50 and 1,000 cfs resulting in a longer sediment detention and settling time.

The reservoir elevation is likely to be much higher than the residual pool elevation of 1,375 feet NGVD during the winter and spring flood control season. A higher reservoir elevation would also increase the sediment detention and settling time. However, the sediment transport analysis conservatively assumed that the residual pool elevation would be maintained throughout the year.

The amount of sediment by size class was estimated from sediment samples. Sediment size class and transport analyses were combined to estimate that approximately half of the potentially transported sediment (approximately 1 million cubic yards [mcy]) would be larger than 0.074 mm (USACE 1995). This fraction (sand and larger material) would be deposited before entering the residual pool or within the first 500 to 1,000 feet within the 1.5 mile-long residual pool. Of the remaining 1 mcy of sediment, 90% would be larger than 0.01 mm and would settle out in the residual pool (or larger reservoir), and the remaining 100,000 cy of sediment (?0.01 mm) would pass through the residual pool to below Cougar Dam. Hence, the relatively large residual pool (2,845 acre-feet and over 1.5 miles long) at elevation 1,375 feet NGVD that would be maintained behind the dam during construction is expected to retain all sediment transported from upstream with the exception of very fine colloidal material (i.e., clay particles, less than 0.01 mm in diameter) that can be easily transported at the flow levels that would occur below Cougar Dam.

Aside from the continuing annual movement of sediment downstream, fine sediment has collected behind Cougar Dam over the past 36 years in the reservoir pool below the depth of the regulating outlet and power penstock intake (at invert elevations 1,479 feet and 1,419 feet NGVD, respectively) down to the diversion tunnel entrance depth of 1,290 feet NGVD. Turbidity profiles measured at Cougar Reservoir in the summer of 1971 showed increased turbidity below the level of the outlet. Turbidity at the bottom was 20 Jackson Turbidity Units (JTU, or mg/l) (USACE 1995). This turbid water would be discharged for a period of unknown length during initial drawdown of the reservoir, but the turbid discharge would likely occur over a relatively short term period (e.g., 10 days or less) based on observations at other impoundments in the Willamette Basin.

Turbidity below Fall Creek Reservoir in the Middle Fork Willamette River Subbasin increased to from 100 to 600 NTUs over a period of approximately nine days when that reservoir was completely drained during November and December of 1989. The highest turbidity occurred only when the reservoir level reached bottom (USACE 1995). Cougar Reservoir would not be completely drained. It would retain a residual pool 85 feet deep.

Turbidity levels sampled below Cougar Dam in 1992 and in 1994 showed a range of 0.6 to 2.9 NTUs (USACE 1995). It has been estimated that turbidity below Cougar Dam during initial drawdown might increase by as much as ten-fold above current average conditions, which might then be from approximately 6 to 30 NTUs.

There is no clear relationship between NTUs and JTUs, but Bell (1990) suggested that "A 5 NTU increase in turbidity…(may) be associated with an increase in suspended sediment concentration of approximately 5-25 mg/l (or JTUs)." Assuming that one NTU is roughly equivalent to 3 JTUs (approximately 15 JTUs/5 NTUs), the short-duration increase in turbidity observed below Fall Creek Reservoir would have been in the range of from 300 to 1,800 JTU. The short-term initial turbidity event that would occur upon drawing down Cougar Reservoir would presumably be in the range of from 18 to 90 JTUs.

Many fishes, including salmon and trout, are able to withstand fairly high concentrations of turbidity (i.e., several thousand mg/l or JTUs) for relatively short time periods of a week or less (Newcombe and Jensen 1996; Newcombe and MacDonald 1991). Lloyd (1987) found that salmon and trout were able to tolerate concentrations of turbidity ranging from approximately 80 to 100 mg/l for extended periods. Thus, direct impacts to pre-spawners and juvenile fish from initial or subsequent high turbidity levels below Cougar Dam are unlikely.

However, Newcombe and Jensen (1996) noted mortality of alevins (sac-fry stage) at suspended sediment concentrations as low as 20 mg/l when exposed for four days. As a result, there could be some unknown level of loss to eggs or alevins during initial drawdown or from occasional short-duration high turbidity events.

Corps modeling indicated that flow energy below Cougar Dam would be more than adequate to keep clay particles discharged from the reservoir in suspension throughout flows through the South Fork and mainstem McKenzie rivers, especially during winter high-flow periods (USACE 1995). Following the potential high turbidity event during initial drawdown of Cougar Reservoir in 2001, winter flows below Cougar Dam would help to re-suspend any fine sediment that might have been deposited. Thus, long-term impacts from compaction with fine sediment to spawning gravel located downstream of Cougar Dam should be negligible.

Summary of Impacts to Spring Chinook Salmon

Improved, more natural, water temperature conditions that will occur in the South Fork McKenzie River during the construction period should result in improved pre-spawner survival rates for fish holding in the South Fork.

Flow levels less than the current minimum of 300 cfs may occur infrequently in the South Fork during average to low flow years. These low flow conditions will directly affect the quantity of pre-spawner and juvenile rearing habitat available in the South Fork. Since inflow to Cougar Reservoir will be passed downstream, flow levels will be equivalent to those that would have occurred if the Cougar project had never been built. Adult pre-spawners in the South Fork have free access to other holding habitat located elsewhere within the McKenzie Basin, and juveniles typically emigrate to rearing habitat located downstream in mainstem areas of the McKenzie and upper Willamette rivers. Neither the quantity nor quality of habitat in the McKenzie Basin is currently considered to be limiting to spring chinook productivity within the basin. Consequently, no significant negative affect on spring chinook salmon from reduced flows during the construction period is anticipated.

Increased levels of turbidity can also directly impact survival rates of pre-spawners, juveniles, alevins and eggs. High levels of turbidity can affect the quality of spawning (i.e., gravel compaction) and rearing (i.e., production of benthic aquatic organisms used as food) habitat. Turbidity levels would increase below Cougar Dam immediately following initial drawdown (most likely during February through March 2001) and, perhaps, intermittently during runoff events under drawdown conditions in June through October. The retention pool above the dam is expected to retain all sediment except for small clay particles that typically remain in suspension for long periods of time. Suspended fine sediments should pass relatively quickly through the lower South Fork and mainstem McKenzie rivers without significant negative impacts to McKenzie River spring chinook salmon. However some fish could be lost during high turbidity events; particularly eggs or alevins during events occurring in February through March 2001.

We did not identify any interrelated and interdependent actions associated with construction period activities. An indirect affect of increased turbidities during construction would be to reduce the effectiveness of harvest by anglers in the McKenzie River and, thus, the incidental capture of naturally produced spring chinook pre-spawners. Effectiveness of predators on juvenile spring chinook might also be reduced, but this potential benefit would probably be offset by the impact of reduced effectiveness of juvenile spring chinook foraging in the same areas.

Bull Trout

<u>Potential Impacts Above Cougar Dam</u>

RESIDUAL POOL MANAGEMENT

A residual pool at elevation 1,375 feet NGVD would be maintained behind Cougar Dam during the construction period (June through October) to retain sediment transported downstream, thus protection water quality below the dam, and to maintain pool habitat for bull trout and other resident fish species occurring in Cougar Reservoir at the time of drawdown. Cougar Reservoir would be drawn down from Minimum Flood Control Pool elevation of 1,532 feet NGVD or higher beginning in February 2001, depending upon precipitation and flow conditions within the McKenzie and Willamette river basins.   The Corps anticipates reaching the residual pool elevation by the end of May (flow modeling indicated an 87% chance of reaching elevation 1,380 feet NGVD by June 1). Following the construction period (most likely some time in October or November), the reservoir would begin to refill. It may or may not refill to or above the Minimum Flood Control Pool elevation of 1,532 feet NGVD during the flood control season, depending upon precipitation and flow conditions within the basin. Drawdown would be re-initiated as early as February and completed by the end of May, if possible, in each subsequent year during 2002-03.

RESIDUAL POOL INFLOW

Mature bull trout have been observed migrating from Cougar Reservoir into headwater spawning areas above the reservoir during April and May (Jeff Ziller, ODFW Springfield, personal communication). As a result, few bull trout may remain in the residual pool following drawdown. Some subadults (age 2-3), however, may remain in the residual pool. Minimum mean daily inflows during April through June into Cougar Reservoir from the SFMR range from 300 to 700 cfs (Table 2) and should provide ample flow volume for fish migrating from the residual pool into headwater spawning and rearing areas. Channel flow velocities above Cougar Reservoir at these levels of discharge range approximately 2 to 3 feet/second (USACE 1998).

Based on pre-dam data, mean water temperatures of inflows to Cougar Reservoir were approximately 42ºF in April, 45ºF in May, 50ºF in June, and 54ºF in July. Average temperatures begin to drop again after July. In 1984, inflow temperatures ranged 43-45ºF in April, 44-49ºF in May, 46-60ºF in June, and 59-62ºF in July (USACE 1995). Adult bull trout prefer stream temperatures at or below 55ºF, and their distribution may be limited at temperatures above 59ºF (Fraley and Shepard 1989). As a result, it is unlikely that bull trout would migrate from the residual pool into headwater areas above Cougar Reservoir after mid June.

RESIDUAL POOL SEDIMENTATION AND TURBIDITY

Redistribution of sediment deposited in the upper end of Cougar Reservoir, along with annual sediment supply from the South Fork and East Fork of the McKenzie River could contribute to turbidity within the residual pool during unusual, short-term summer storm events. However, most sediment transport will occur under winter flow conditions when the reservoir will be at a higher elevation.

Cougar Reservoir is very steep-sided, and the shoreline is composed primarily of bedrock, cobble, gravel and sand. Average rainfall during the summer (June through September) is only 7.68 inches (11.4% of mean annual precipitation). As a result, summer runoff from exposed reservoir slopes is unlikely to contribute substantively to turbidity levels in the residual pool. However, mass wasting from slides within the exposed reservoir area could contribute to high turbidity events in the residual pool and downstream of Cougar Dam, if they should occur. The rate of drawdown would be kept at or below 3 feet/day to minimize chances of a slide occurrence (USACE 1998).

Sediment transport modeling analysis (USACE 1998) indicated that sand and larger material would be deposited before reaching the residual pool or within the first 500 to 1,000 feet within the 1.5 mile-long pool, primarily during winter high-flow events. Based on a minimum residual pool detention time of only 17 hours and particle size-specific terminal fall velocities, it was estimated that approximately 90% of the finer silt (between 0.01 and 0.074 mm in diameter) would settle out fairly quickly within the residual pool (or larger reservoir), leaving only clay particles (less than 0.01 mm in diameter) in suspension. Observations of turbidity levels that occurred when the Corps drew down Detroit Reservoir on the North Santiam River also suggest that highly turbid conditions are unlikely to develop in the Cougar residual pool under normal flow conditions.

Many fishes, including salmon and trout, are able to withstand fairly high concentrations of turbidity (i.e., several thousand mg/l or JTUs) for relatively short time periods of a week or less (Newcombe and Jensen 1996; Newcombe and MacDonald 1991). Lloyd (1987) found that salmon and trout were able to tolerate concentrations of turbidity ranging from approximately 80 to 100 mg/l for extended periods. The turbidity levels expected to occur in the residual pool should be much lower than this. Thus, direct impacts are unlikely from high turbidity levels to adult and subadult bull trout residing in the residual pool during summer or over-wintering in Cougar Reservoir.

RESIDUAL POOL TEMPERATURE AND FISH DISTRIBUTION

The structure and volume of the residual pool would be such that it would stratify during the summer construction period. Currently, Cougar Reservoir begins to stratify each summer at a depth of from 5 feet to10 feet in April or May. The thermocline is forced downward during the summer to a depth of from 20 feet to 30 feet by October, after which stratification breaks up. Modeling of temperature profiles at depth in the residual pool (USACE 1995) suggested a similar stratification pattern beginning at a depth of approximately 5 feet (June) to10 feet (September) with fairly uniform temperatures of from 60ºF (June and September) to 62ºF (July and August) occurring at and below a depth of approximately 35 feet.

Although there is a lack of information concerning the distribution of bull trout within Cougar Reservoir, the ways in which fish in general distribute in lakes and reservoirs, especially during summer periods of thermal and chemical stratification, are well documented. Most species distribute near the thermocline where the water is both cool and well oxygenated, though some species or developmental stages (e.g., relatively small juveniles) prefer warmer temperatures, vegetated areas, or shallower, more protected habitats near the shoreline in the epilimnion. Fish species rarely distributed below the thermocline, in the hypolimnion, unless forced to do so because of high water temperatures occurring above the hypolimnion. Some species such as kokanee, walleye, and yellow perch are pelagic and may distribute in the water column well above the reservoir bottom, but most species are demersal, occurring on or near the bottom. Species like bull trout, for which habitat structure is important (63 FR 31647), are demersally distributed.

Goetz (1989) suggested optimum water temperatures for bull trout rearing of 44-46ºF. Fraley and Shepard (1989) indicated that water temperature above 59ºF is likely to limit bull trout distribution. Recent information regarding migratory behavior of bull trout suggests that adults overwintering in Cougar Reservoir may move upstream into spawning areas in the upper watershed above the reservoir during April and May (Jeff Ziller, ODFW Springfield, personal communication). Given the likely water temperature conditions in the residual pool after mid-June and the preferred temperature range of bull trout, few if any bull trout may remain in the residual pool during the construction period.

Based on the facts that residual pool temperatures are likely to be uniform below a depth of 35 feet, that bull trout are opportunistic and voracious predators likely to be distributed where prey species would be most abundant, and that most species in reservoirs, including bull trout, are distributed demersally in the vicinity of the thermocline, it is likely that bull trout remaining in the residual pool would occur at a depth of approximately 35 feet along the bottom (upper end) or perimeter (lower end) of the residual pool. This depth is relatively near the surface and away from the intake to the diversion tunnel at a depth of 85 feet near the dam. Such a distribution would reduce the likelihood of bull trout entrainment into the diversion tunnel during the construction period. As a result, the Corps anticipates that few bull trout remaining in Cougar Reservoir are likely to be negatively impacted from passage through the diversion tunnel. However, bull trout actively seeking a passage route to below Cougar Dam may seek out and become entrained in flow entering the bypass tunnel.

Potential Impacts Below Cougar Dam

INSTREAM FLOWS

Natural stream flow volume, similar to conditions occurring prior to construction and operation of Cougar Dam, will occur below the dam during reservoir drawdown for WTC project construction activities (approximately June through October), unless there is a need to implement flood management procedures. The occurrence of flood level flows from mid June through October is unlikely. Normally, inflows to Cougar Reservoir range between approximately 50 and 1,000 cfs during this time period (Table 2).

There will be times during August and September in average to low flow years when discharge below Cougar Dam falls below current minimum levels of 300 cfs. Modeling results indicated that flows below 300 cfs during the construction period are likely to occur from five to eight times annually (USACE 1995).

The primary potential impact of changes in flow below Cougar Dam on bull trout productivity would be with regard to changes in habitat quantity available for adult and subadult (age 2-3) rearing in the South Fork McKenzie River. Bull trout are not common in the South Fork, but they are caught there on a regular basis by anglers (Jeff Ziller, ODFW Springfield, personal communication). Consequently, it is unlikely that rearing habitat availability is limiting to bull trout productivity in the South Fork McKenzie River downstream of Cougar Dam.

WATER TEMPERATURE

Although flow volume in the South Fork and mainstem McKenzie River may be reduced somewhat in average to low flow years, stream temperatures during summer rearing and fall migration periods will be improved and more natural (i.e., warmer in summer and cooler in fall) than current environmental conditions.

The Final EIS (USACE 1995) discusses effects on water temperature resulting from loss of riparian cover through the reservoir area under drawdown conditions. Flow and temperature modeling indicated that flows released from the residual pool above the dam would average approximately 58? to 63?F daily (only 3-6F? warmer than inflow temperatures) during the hottest summer month (i.e., August). Slightly increased water temperature conditions would be more conducive to the production of benthic invertebrates, and to the overall productivity of fishes occurring downstream of Cougar Dam in the South Fork McKenzie River.

TURBIDITY

The Corps examined the potential sediment supply that might be redistributed downstream during the four-year construction period. Under drawdown conditions, sediment would originate from deposits in the upper end of Cougar Reservoir along with the normal annual sediment loads from the South Fork and East Fork of the McKenzie River. Most transport would occur in winter or spring (November through May) during high-flow events. Typically, flows peak in December with a mean monthly flow of around 1,300 cfs (Table 2). A flow level of 2,000 cfs was used to perform the sediment transport analysis. Actual summer inflow to the residual pool would most likely range between approximately 50 and 1,000 cfs resulting in a longer sediment detention and settling time.

The reservoir elevation is likely to be much higher than the residual pool elevation of 1,375 feet NGVD during the winter and spring flood control season. A higher reservoir elevation would also increase the sediment detention and settling time. However, the sediment transport analysis conservatively assumed that the residual pool elevation would be maintained throughout the year.

The amount of sediment by size class was estimated from sediment samples. Sediment size class and transport analyses were combined to estimate that approximately half of the potentially transported sediment (approximately 1 million cubic yards [mcy]) would be larger than 0.074 mm (USACE 1995). This fraction (sand and larger material) would be deposited before entering the residual pool or within the first 500 to 1,000 feet within the 1.5 mile-long residual pool. Of the remaining 1 mcy of sediment, 90% would be larger than 0.01 mm and would settle out in the residual pool (or larger reservoir), and the remaining 100,000 cy of sediment (?0.01 mm) would pass through the residual pool to below Cougar Dam. Hence, the relatively large residual pool (2,845 acre-feet and over 1.5 miles long) at elevation 1,375 feet NGVD that would be maintained behind the dam during construction is expected to retain all sediment transported from upstream with the exception of very fine colloidal material (i.e., clay particles, less than 0.01 mm in diameter) that can be easily transported at the flow levels that would occur below Cougar Dam.

Aside from the continuing annual movement of sediment downstream, fine sediment has collected behind Cougar Dam over the past 36 years in the reservoir pool below the depth of the regulating outlet and power penstock intake (at invert elevations 1,479 feet and 1,419 feet NGVD, respectively) down to the diversion tunnel entrance depth of 1,290 feet NGVD. Turbidity profiles measured at Cougar Reservoir in the summer of 1971 showed increased turbidity below the level of the outlet. Turbidity at the bottom was 20 Jackson Turbidity Units (JTU, or mg/l) (USACE 1995). This turbid water is likely to be discharged over a relatively short-term period (e.g., 10 days or less) during initial drawdown of the reservoir.

Turbidity below Fall Creek Reservoir in the Middle Fork Willamette River Subbasin increased to from 100 to 600 Nephelometric Turbidity Units (NTU) over a period of approximately nine days when that reservoir was completely drained during November and December of 1989. The highest turbidity occurred only when the reservoir level reached bottom (USACE 1995). There is no clear relationship between NTUs and JTUs, but Bell (1990) suggested that “A 5 NTU increase in turbidity…(may) be associated with an increase in suspended sediment concentration of approximately 5-25 mg/l (or JTU).” Assuming that one NTU is approximately equivalent to 3 JTU (15JTU/5NTU), the short-duration increase in turbidity observed below Fall Creek Reservoir would have been in the range of from 300 to 1,800 JTU. The short-term initial turbidity event that would occur upon drawing down Cougar Reservoir should be much less than this amount in that the reservoir will not be totally drained.

Corps modeling indicated that flow energy below Cougar Dam would be more than adequate to keep clay particles discharged from the reservoir in suspension throughout flows through the South Fork and mainstem McKenzie rivers, especially during winter high-flow periods (USACE 1995). Many fishes, including salmon and trout, are able to withstand fairly high concentrations of turbidity (i.e., several thousand mg/l or JTUs) for relatively short time periods of a week or less (Newcombe and Jensen 1996; Newcombe and MacDonald 1991). Lloyd (1987) found that salmon and trout were able to tolerate concentrations of turbidity ranging from approximately 80 to 100 mg/l for extended periods. Thus, direct impacts to bull trout from high turbidity levels are unlikely. The effectiveness of bull trout foraging downstream of Cougar Dam on juvenile spring chinook salmon or on other prey might be reduced as a result of increased turbidity, but this impact may also be offset by the increased productivity of prey species resulting from slightly increased water temperatures.

Summary of Impacts to Bull Trout

A relatively large residual pool (2,845 acre-feet, 1.5 miles long, 85 feet deep) would be provided for bull trout remaining in Cougar Reservoir during the drawdown and construction period (June through October). Turbidity within the residual pool is not likely to be a problem, given the size of the pool in relation to the potential sediment load from upstream and the small chance of heavy precipitation events during the drawdown period.

Water temperatures within the residual pool may be problematic. However, bull trout have been observed to migrate upstream out of Cougar Reservoir in April and May before reservoir and river water temperatures become elevated. Few bull trout may remain in the residual pool during the construction season. Water quality and biological monitoring will be employed to determine if the residual pool provides adequate protection for bull trout during the initial drawdown period (June through October 2001). Alternative or additional mitigation measures (e.g., minimization of bull trout occurring in the residual pool) approved by USFWS may be undertaken in subsequent drawdown seasons, if necessary to protect bull trout.

Bull trout are likely to be distributed where the thermocline intersects substrate within the residual pool. Modeling indicated that this would occur at a depth of approximately 35 feet (USACE 1995). This distribution would place bull trout well above the entrance to the diversion tunnel at 85 feet. During the summer drawdown period, inflows to the residual pool will be passed to below Cougar Dam through the diversion tunnel. The low level of inflows (50-1,000 cfs) that normally occur during this time period are not likely to entrain bull trout into the diversion tunnel. However, bull trout actively seeking a passage route to below Cougar Dam may seek out and become entrained in flow entering the bypass tunnel. Mortality of fish passing through the diversion tunnel is expected to be high.

Drawdown of Cougar Reservoir for construction of the WTC structure is, therefore, likely to impact some unknown number of bull trout remaining in the reservoir which may pass through the diversion tunnel during drawdown and during subsequent maintenance of the residual pool. Bull trout remaining in the reservoir during the drawdown period may avoid passing through the diversion tunnel by either remaining in the residual pool or migrating upstream into the watershed above the reservoir.

Under drawdown conditions, stream flows and water temperature conditions occurring below Cougar Dam will be more natural and conducive to normal environmental conditions for indigenous fish populations. These conditions should be beneficial for bull trout rearing throughout the construction season and throughout the year. The more natural flow conditions and water temperatures that would occur below Cougar Dam during August and September would provide a better environment for adult bull trout migration than currently occurs under baseline conditions. Re-initiation of normal flood control operations in October or November would not have a different affect from current baseline conditions on bull trout located below Cougar Dam. Affects of irregular increases in turbidity below Cougar Dam resulting from erosion of sediments above the dam are expected to have little, if any, impact on fishes. As a result, the Corps anticipates generally improved environmental conditions for bull trout below Cougar Dam as a result of implementation of the proposed project.

Turbidity levels downstream of Cougar Dam would increase as a result of Cougar Reservoir drawdown for construction activities. In particular, the initial drawdown during February through May 2001 may result in short-term high turbidity. Flow energy downstream of Cougar Dam would be sufficient to keep the small (i.e., clay) sediment particles passed below Cougar Dam in suspension throughout the lower South Fork and mainstem McKenzie rivers. Direct impacts to bull trout from high turbidity levels are unlikely. The effectiveness of bull trout foraging downstream of Cougar Dam on juvenile spring chinook salmon or on other prey might be reduced as a result of increased turbidity. This impact, however, may also be offset by the increased productivity of prey species resulting from slightly increased water temperatures in comparison to current temperature conditions during summer.

We did not identify any interrelated and interdependent actions associated with construction period activities. An indirect affect of increased turbidities during construction would be to reduce the effectiveness of harvest by anglers in the McKenzie River and, thus, the incidental capture of bull trout.

Bald Eagle

During the first year of drawdown (2001), fish would be plentiful for eagles due to a concentration of fish. In the following two years of drawdown, fish will likely decline in abundance. Trout stocking at the reservoir is not expected to occur during construction. Many of the trout stocked previously to construction will be harvested by anglers. A reduced population of stocked and wild trout will remain in the reservoir during the construction period.

Northern Spotted Owl

The proposed action will not remove spotted owl nesting, roosting, foraging or dispersal habitat. However, noise from traffic, equipment, construction, and blasting has the potential to disturb spotted owl foraging, roosting and nesting behavior. Rock material will be removed by blasting at three sites: the main diversion tunnel, Rush Creek diversion tunnel, and the Cougar Reservoir intake structure. Use of equipment such as rock drills, cranes, and dozers will emit additional noise.

The Rush Creek spotted owl activity area is approximately 0.7 miles south of the exit portal for the main diversion tunnel. Blasting to reopen the tunnel will occur inside the diversion tunnel (i.e., underground) 600 feet or more from the portal. The loudest vehicles (e.g., crane, tractors, backhoes) and equipment (e.g., rock drill, jackhammer) would generate a maximum 100 dBA at 50 feet. Over the 0.7 mile distance which separates the Rush Creek spotted owl activity area from proposed construction activities at the exit portal of the main diversion tunnel, noise from construction activities would be reduced by approximately 51 decibels, to a maximum 49 dBA. Expected blasting noise at the exit portal (approximately 100 dBC) would be reduced by 47 dBC, to a maximum 53 dBC at the spotted owl activity area. These estimates of noise level reduction do not take into account additional reducing factors such as dense vegetation, topography, and break in line-of-sight. These modifying factors would likely result in an additional 15 decibels or more reduction in noise from construction and blasting activities.

The Rush Creek spotted owl activity area is approximately 2,000 feet south of the intake portal for the Rush Creek diversion tunnel. Excavation of the intake portal will occur from late-March to mid-June 2001. The intake is at the bottom of a 260-foot deep canyon. Adjacent slopes are forested. The loudest vehicles (e.g., crane, tractors, backhoes) and equipment (e.g., rock drill, jackhammer) will generate a maximum of 100 dBA at 50 feet (Western Highway Institute 1971). Over the 2,000 feet distance which separates the Rush Creek spotted owl activity area from proposed construction activities at the entrance portal to the Rush Creek diversion tunnel, noise from construction activities would be reduced by approximately 41 decibels, to a maximum 59 dBA. If large boulders are encountered in the diversion tunnel shaft, blasting will be necessary to break apart the rock into smaller pieces that can then be removed by hand. Because these shots will occur inside the tunnel, the expected sound level at the surface would be 100 dBC. Expected blasting noise would be reduced by 40 dBC, to a maximum 60 dBC at the spotted owl activity area. The previously mentioned noise modifying factors would likely result in an additional 15 decibels or more reduction in noise from construction and blasting activities.

The Rush Creek spotted owl activity area is approximately 2,800 feet south of the Cougar Lake intake structure. The structure is positioned within a narrow cut at the back of a horseshoe shaped basin. Blasting to excavate the regulating outlet bench and penstock channel will occur from early-April through mid-July 2001. Vehicles and heavy equipment will be used within a 300-foot-radius of the existing intake structure from mid-March to mid-July 2001. The loudest vehicles (e.g., crane, tractors, backhoes) and equipment (e.g., rock drill, jackhammer) will generate a maximum 100 dBA at 50 feet (Western Highway

Institute 1971). Over the 2,800 feet distance which separates the Rush Creek spotted owl activity area from proposed construction activities at the intake structure, noise from construction activities would be reduced approximately 46.3 decibels, to a maximum 53.7 dBA. Maximum expected blasting noise (130 dBC at the intake structure) would be reduced 44 dBC, to a maximum 86 dBC at the spotted owl activity area. These blasts will occur within an existing basin, which will tend to direct the noise southeast into the Cougar Reservoir basin. The previously mentioned noise modifying factors would likely result in an additional 15 decibels or more reduction in noise from construction and blasting activities.

Three additional spotted owl activity areas occur within 2 miles of Cougar Reservoir. Two are at least 1 mile from the project site and one is more than 1.5 miles away. Distance, vegetation and topography would reduce construction noise in these activity areas to ?42 dBA at a distance of 1 mile from the project site and ?32 dBA 1.5 miles from the project site. Noise from blasting would be reduced to ?64 dBC and ?60 dBC at a distance of 1 mile and 1.5 miles, respectively, from the project site.

Canada Lynx

Although lynx have been detected in the project vicinity (nearest unconfirmed sighting was 2.5 miles from Cougar Dam), the project site does not contain suitable habitat for the species. The main diversion tunnel outlet is located in a narrow basin unlikely to attract or support prey items for lynx. Blasting will occur during the time of year when lynx are expected to have moved to higher elevations (i.e., > 4,000 feet) well out of range of blasting noise disturbance. Drawdown will result in lower instream flow, but this will not impact the density or structure of vegetation in lynx winter foraging habitat. Increased production of annuals in the riparian zone may provide additional food for lynx prey but this would be a minor increase. Lynx are not likely to occur at the elevation of Strube Flat.

RESPONSE OF SPECIES TO PROPOSED ACTIONS

Upper Willamette River Spring Chinook Salmon

A higher proportion of the McKenzie River spring chinook pre-spawner population than normally enters the South Fork McKenzie River (i.e., approximately 10%) may be attracted into the South Fork because of improved, more natural water temperature conditions during the construction period depending on flow rates and other water quality conditions. A smaller proportion of the pre-spawner population may enter the South Fork under low flow or highly turbid flow conditions. In either case, pre-spawner survival rates in the South Fork are expected to improve under water temperature conditions that occur during the construction period.

Adult and juvenile migrations and rearing juvenile spring chinook salmon in the action area, in the mainstem McKenzie River, and in the Willamette River are not expected to be impacted as a result of the proposed action. However, an unknown level of mortality to eggs or alevins could occur as a result of short-term high turbidity events.

Conclusion: The proposed action may affect, and is likely to adversely affect, spring chinook salmon.

The Corps is currently investigating options for safely passing fishes, including spring chinook salmon, around Cougar Dam. This investigating is being conducted under a reconnaissance-level study authorized by Congress in association with their approval of the Cougar WTC project. For a discussion of associated factors affecting spring chinook salmon, see "TRAP AND HAUL FACILITIES" under "**Bull Trout**" below.

Bull Trout

Information is unavailable or incomplete regarding potential impacts to bull trout above Cougar Dam or appropriate associated mitigation actions. Mortality is likely to occur to an unknown number of bull trout that may pass through the diversion tunnel during drawdown and during subsequent maintenance of the residual pool. However, the likely distribution of bull trout remaining in the residual pool (at a depth of from 20 to 40 feet), together with the location of the diversion tunnel inlet (at a depth of 85 feet) and the low levels of discharge that normally occur during summer (50 to 1,000 cfs), would minimize the likelihood of bull trout entrainment.

Environmental conditions below Cougar Dam during construction are expected to be better for bull trout than current baseline conditions. As a result, few if any negative impacts to bull trout located below the dam are anticipated. Bull trout occurrence, distribution, and productivity under drawdown conditions should be relatively equivalent to current conditions in that area.

Conclusion: The proposed action may affect, and is likely to adversely affect, bull trout.

MITIGATION ACTIONS

The Corps would continue to consult with USFWS to define reasonable and prudent mitigation actions necessary to protect bull trout during implementation of the Cougar WTC project. At present, mitigation measures that the Corps would implement include providing a residual pool for bull trout use during the construction period, and replacing an existing fish trap located below Cougar Dam with one suitable for capturing and transporting adult and subadult bull trout from below the dam to spawning and rearing areas located above the reservoir.

Water quality and biological monitoring, as described below, would be performed during the construction period to identify problems that may arise and to provide valuable information useful for future project planning and design. Studies would be performed, beginning in the year 2000 prior to initial reservoir drawdown, to identify remedial actions that might be taken in the event that initial mitigation measures are ineffective, and to provide information needed for siting and design of fish trapping facilities. Biological monitoring during initial drawdown would be employed to detect any stranding of fishes that might occur, and to identify related needs for remedial action.

An Environmental Coordination Task Force (ECTF) consisting of federal and state regulatory agency representatives would be established to assist the Corps in reviewing study and monitoring results. The ECTF would also assist the Corps in identifying needs for corrective action, formulating recommendations for facility design and corrective action, implementing corrective actions, and providing information concerning the project to their constituencies and to the public. Initially, the ECTF would meet on a quarterly basis, or as needed to address project needs.

Alternative mitigation actions that could potentially be implemented to protect bull trout include trapping of adults and juveniles above Cougar Reservoir in an effort to reduce the number of bull trout occurring in the residual pool during the summer drawdown and construction period. Unfortunately, techniques for safely trapping, handling, transporting, and holding bull trout have not been well developed. If the residual pool habitat is found to be benign following the initial drawdown period, alternative mitigation could include early supplementation of bull trout spawning above the reservoir through trapping and transport of spawners from below Cougar Dam during subsequent drawdown and construction periods.

The Corps will work with ODFW to study the movement of bull trout into and out of Cougar Reservoir and the area below Cougar Dam. The Corps will also work with ODFW to test trapping techniques for bull trout above and within the reservoir and below the dam. Studies will be initiated during the year 2000; one year prior to initial drawdown for construction activities, as described in more detail under “TRAP AND HAUL FACILITIES” below. If feasible (based on potential sample size and likely resulting accuracy of information obtained), behavior of bull trout within the reservoir will also be examined. The intent of the study is to provide the Corps with information regarding an acceptable alternative protection strategy (i.e., trapping within or above the reservoir) that can be taken if necessary to protect bull trout, and with information pertinent to siting and design of trap-and-haul facilities for bull trout below (and, potentially, above) the dam.

Implementation of alternative protective actions for bull trout (i.e., trapping within or above the reservoir) during the construction phase of the Cougar WTC project would depend on whether the protection provided as a result of maintaining a residual pool behind Cougar Dam during the construction period proved to be an adequate protective measure. The study would examine bull trout migratory behavior, capture and handling techniques, and captive broodstock retention techniques. The Corps would ask the ECTF to review and comment on the study plan and on the results and recommendations from the study. USFWS approval of the study plan, and of any resulting course of action, would be required.

The Corps and the ECTF would follow results from water quality and biological monitoring during implementation of the Cougar WTC project. If water quality and biological monitoring during the 2001 (initial) construction period indicated that bull trout remaining in the residual pool were at high risk, the Corps would implement recommendations approved by USFWS for removing bull trout from Cougar Reservoir prior to subsequent periods of drawdown and construction.

Problems that might develop for bull trout remaining in the residual pool during the summer construction period would most likely be related to high water temperature and associated stress. It would not be practical under these circumstances to attempt capture and handling of the stressed fish, as this would surely increase their mortality rate. Corrective action might include more intensive interception of bull trout migrating downstream from above Cougar Reservoir during subsequent migration periods or capture and removal of bull trout from Cougar Reservoir prior to subsequent periods of drawdown and construction. Under these circumstances, efforts would be made to reduce and minimize the number of bull trout occurring in the residual pool during drawdown.

If protective trapping were initiated (in 2002), it would be continued during normal emigration periods (February through September, or as recommended) throughout the remaining one to two years (during 2003-2003) of construction according to a protocol recommended and approved by USFWS. Also, bull trout captured during trapping would be transported and released below Cougar Dam or retained as captive brood stock according to the protocol recommended and approved by USFWS. These measures would be intended to minimize impacts to bull trout occurring in or above Cougar Reservoir that may result from implementation of the proposed construction project.

TRAP AND HAUL FACILITIES

Protection of bull trout during the proposed action is an important short-term objective, and restoration of connectivity for bull trout subpopulations located above and below Cougar Dam is an important long-term objective associated with the Cougar WTC project. In addition, defining the potential for re-establishment of a self-sustaining anadromous spring chinook salmon population segment utilizing natural spawning and rearing habitat located above Cougar Reservoir is another project objective. Realization of these objectives would require new information concerning the behavior of bull trout and of spring chinook salmon located above and below Cougar Dam, and concerning the feasibility of a trap-and-haul program, or alternative fish passage mechanism, needed to safely and efficiently pass these fishes around the dam.

Based on long-term biological objectives for bull trout and for spring chinook salmon (to be defined by the USFWS and by the NMFS, respectively), the Corps would design and construct a fish trap below or above Cougar Dam that is capable of safely capturing and transporting adult fish from below the dam to spawning and rearing areas located above the reservoir, or from above the dam to rearing areas and migration corridors located below the dam. Options for providing safe passage for fish to above and below Cougar Dam are currently under study by the Corps (i.e., a reconnaissance level study). Bull trout would be transported upstream (and, possibly, downstream) following completion of the Cougar WTC project construction activities and refilling of Cougar Reservoir, unless the Corps was directed by USFWS to transfer bull trout to above the dam prior to project completion. The Corps would coordinate with USFWS, NMFS, and ODFW regarding the design of fish trapping facilities.

The Corps is currently investigating the possibility of designing a trap capable of capturing and transporting both bull trout and spring chinook salmon. We anticipate that ODFW would operate the trap under a cooperative agreement with the Corps. The Corps would maintain the trap and would provide trucks and equipment necessary for transporting fish that would be liberated above or below the dam. An annual operating plan would be developed jointly with NMFS, USFWS, and ODFW. It would, presumably, be implemented by ODFW and the Corps.

During the Cougar WTC project construction period (2000-2003), adult and juvenile bull trout and spring chinook salmon would be trapped experimentally both above and below Cougar Reservoir. Initial trapping would begin one year before initial reservoir drawdown beginning in February 2001. Studies would be performed to identify remedial actions (i.e., safe trapping and handling techniques) that might be taken to protect bull trout in the event that initial mitigation measures (i.e., providing a residual pool) are ineffective, and to provide information needed for siting and design of permanent fish trapping and handling facilities.

The Corps would work with ODFW to develop a protocol for trapping and handling bull trout. The protocol would be reviewed and monitored by the ECTF, and approved by NMFS and USFWS. It would be reviewed at least annually and might be revised at any time to increase operational efficiency based upon new knowledge.

Bull trout that are collected upstream of Cougar Dam would either be released downstream of Cougar Dam or taken to a temporary holding facility, depending on an operational plan approved by the USFWS. The disposition of bull trout trapped below Cougar Dam would be decided by the Corps in consultation with the USFWS. Options for the disposition of bull trout trapped below the dam would be reviewed by the ECTF, and the Corps would consider its recommendations in formulating the Corps's recommendation to USFWS. Potential disposition options, prior to completion of the Cougar WTC project, include liberation of bull trout below the dam where they were caught or transport and liberation above the dam. Spring chinook salmon trapped above or below Cougar Dam would be transported and released on the opposite side of the dam from where they were caught.

Once biological objectives, and associated facility design criteria, for reconnecting bull trout subpopulations located above and below Cougar Reservoir, and for re-establishing natural anadromous spring chinook salmon production above Cougar Reservoir, have been defined by USFWS and by NMFS, respectively, a permanent fish trapping facility would be designed and constructed by the Corps below Cougar Dam. If needed (and approved by Congress), another facility would be designed and constructed above the dam. Experimental trapping (presumably, by ODFW), as described above, would be used to provide information needed for design and siting of the permanent trapping facility.

Conceptually, below Cougar Dam a weir would be used to prevent further upstream migration and to direct migrants toward the trap entrance. Fish would be attracted into a fishway entrance and pass over a false weir into a holding tank. Fish would collect in the tank until it was lifted by a crane or other means and the load was transferred to a truck for transport to a release site. The frequency of operation would depend upon the number of fish collected per unit of time, the capacity of the holding tank, and other facility operational criteria. A means of separating large fish from smaller (e.g., juvenile) fish would be needed to protect the smaller fish from predation or aggression.

The Corps does not anticipate completing and initiating operation of permanent trap-and-haul facilities before completion of the proposed Cougar WTC project construction period in 2003, at which time bull trout can be safely released above the reservoir. Trap and haul facilities would remain operational indefinitely to ensure that bull trout subpopulations located above and below Cougar Reservoir would remain connected.

Bald Eagle

There are no known nesting bald eagles in the McKenzie basin, but occasional wintering bald eagles do occur in the project vicinity. In the first year of drawdown, forage (fish) would be plentiful for eagles but in the following two years of drawdown the fish population would decline. However, the loss would affect very few or possibly no eagles, and fish populations are expected to rebound after the construction period. Project-related impacts to other potential prey resources such as waterfowl will also be minimal.

<u>Conclusion:</u> The proposed action is not likely to adversely affect bald eagles.

Northern Spotted Owl

Proposed actions would not remove spotted owl nesting, roosting, foraging, or dispersal habitat. Drawdown of Cougar Reservoir would have no effect on adjacent forested areas, and the predicted change in instream flows below the dam would have no impact on riparian forest habitat. Noise that would be emitted by vehicles, equipment, and blasting occurring in the project would have the potential to impact spotted owls in the project vicinity. Construction and blasting would occur during the spotted owl nesting period (March-June).

Spotted owls in the project vicinity are expected to have acclimated to ambient background noise levels. Vehicles on the Aufderheide Scenic Byway travelling at 50-60 mph would produce approximately 60 dBA at 50 feet (USDOT 1980). Over the 1,000 feet distance that separates the byway from the Rush Creek spotted owl activity area, traffic noise would be reduced approximately 32.5 dBA, to a maximum 27.5 dBA. Construction noise is not expected to combine with noise from the highway to result in levels substantially louder than those predicted, as vehicle traffic will be slowed or stopped during construction. Traffic noise would combine with background noise that typically occurs in less disturbed forested stands used by spotted owls. Delaney et al. (1999) recorded noise levels near spotted owl nest sites of 25-35 dB, reaching upwards of 40 dB on windy days. Expected ambient noise at the Rush Creek spotted owl activity area is approximately 30-40 dBA.

Delaney et al. (1999) found that Mexican spotted owls did not flush from nests when the noise from helicopters or chain saws was >105 m (344.4 ft.) away. Spotted owls did not flush when the noise level from helicopters was ?102 dBO[3] (92 dBA) and the LEQ (average sound level per time unit) level for chain

[3] Because both flat- and A-weighting do not accurately reflect the way a spotted owl hears noise, the researchers developed an estimated owl-weighting (dBO) curve. This owl-weighting

saws was ?59 dBO (46 dBA). Nesting success was not affected by noise at these levels. All adult flushes during the nesting season occurred after juveniles had left the nest. Mexican spotted owls were more responsive to chain saw noise than they were to helicopter noise. Chain saws start abruptly with an associated startle effect, whereas approaching helicopters are preceded by a gradual increase in noise levels. In this sense, blasting noise is more similar to chain saw noise than it is to helicopter noise. Hence, noise from equipment that is either >105 m (344.4 feet) from a spotted owl activity center or is ?46 dBA is not likely to disturb nesting activity in spotted owls.

Spotted owl response to helicopters and chainsaws can not be easily used to predict response to blasting noise. Noise from rock blasting is characterized as having considerable low-frequency energy, which is filtered out with A-weighting. It is not possible to convert from one weighting to another without the noise spectrum of the sound. While Delaney et al. (1999) used an A-weighted scale, they determined that distance was a better predictor of spotted owl response than noise levels. Distance is the most commonly used surrogate for noise exposure in the animal effects literature (Awbrey and Bowles 1990).

Four spotted owl activity areas occur within the project vicinity. Three activity areas are more than one mile from the construction area. This distance, combined with topography and forest vegetation, would reduce construction and blasting noise to ?42 dBA and ?64 dBC, respectively. Construction noise would be below the noise level threshold for spotted owls (Delaney et al. 1999). Blasting noise would be below the DEQ standard (i.e., 93-98 dBC). Moreover, spotted owls are not likely to flush when noise stimuli are >340 feet away (Delaney et al. 1999). Consequently, construction and blasting noise emitted ?1 mile from a spotted owl activity area is not expected to result in disturbance to spotted owls.

The fourth spotted owl activity area is in the lower Rush Creek watershed, approximately 0.7 miles from the exit portal for the main diversion tunnel. Estimated noise levels at the spotted owl activity area resulting from construction and blasting at the exit portal would be ?49 dBA and ?53 dBC, respectively. These noise estimates do not take into account additional reducing factors such as dense vegetation, topography, and break in line-of-sight. The 435-feet-tall Cougar Dam and steep rock walls to the west and east of the construction site would attenuate noise and direct it downstream, away from the spotted owl activity area. These modifying factors would reduce noise to a level that would be indistinguishable from natural ambient background noise.

The spotted owl activity area in Rush Creek is approximately 2,000 feet from the Rush Creek diversion tunnel inlet and approximately 2,800 feet from the intake tower. Heavy equipment such as rock drills, cranes, and backhoes will be

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emphasized the middle frequency range where spotted owls tested had the highest hearing sensitivity.

used at these sites as early as late-March. Maximum anticipated noise levels at the spotted owl activity area from construction would be 59 dBA. This level of noise is approximately 19 dBA above the estimated background noise level at the spotted owl activity area and exceeds the noise level threshold for spotted owls (Delaney et al. 1999). Modifying factors such as break in line-of-sight, topography, and vegetation would reduce this level of noise, but the influence of these factors are impossible to accurately estimate. Spotted owls are not likely to flush during the nesting period, particularly when noise stimuli are >340 feet away (Delaney et al. 1999). However, such a response can not be entirely discounted due to the close proximity of the construction site to the Rush Creek spotted owl activity area.

Blasting will occur from mid-April to mid-June at the Rush Creek diversion tunnel and from early-April to mid-July at the Cougar Reservoir intake structure. The number and frequency of shots to re-open the Rush Creek diversion tunnel will not be known until boulders are encountered. A total of 9 shots will occur at the intake structure, at a frequency of 2 shots per week, over a 2-month period. All blasting will be completed by mid-July 2001. Maximum anticipated noise levels at the Rush Creek spotted owl activity area from blasting would be 86 dBC. Modifying factors such as break in line-of-sight, topography, and vegetation would reduce this level of noise at least 15 dBC. Although blasting noise would be below the DEQ standard (i.e., 93-98 dBC), it is not known if this level would protect spotted owls from potential disturbance. Spotted owls are not likely to flush during the nesting period, particularly when noise stimuli are >340 feet away (Delaney et al. 1999). However, such a response can not be entirely discounted due to the close proximity of the construction site to the Rush Creek spotted owl activity area.

Conclusion: The proposed action may affect, and is likely to adversely affect, Northern spotted owls.

Canada Lynx

Blasting associated with construction activities will occur during the time of year when lynx are expected to have moved to higher elevations. The blasting will occur either underground or within a confined basin. The level of noise from blasting will not be sufficient to impact lynx foraging at elevations well above the reservoir in summer. Thus, no impacts to lynx are anticipated from the blasting.

Lower instream flow associated with summer drawdown would not impact the density or structure of vegetation in lynx foraging habitat. Increased production of annuals in the riparian zone may provide additional food for lynx prey but this would be a minor increase. Vegetation at the lay down/material storage site at Strube Flat would be trampled or cleared. This low-elevation site is not likely to support use by Canada lynx. Similarly, the main diversion tunnel outlet does not provide lynx foraging habitat.

Conclusion: The proposed action will not affect Canada lynx.

CUMULATIVE EFFECTS

The Final ESA Section 7 Consultation Handbook (USFWS and NMFS 1998) defines cumulative effects, for ESA assessment purposes, as “effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area.” A review of available information, particularly the South Fork McKenzie Watershed Analysis (USFS 1994), indicated that pertinent non-federal activities likely to occur in the project area included industrial forest management on private lands, recreation, hydropower production, and urban and rural development.

INDUSTRIAL FOREST MANAGEMENT

Over 90% of the McKenzie River Subbasin is currently in forest uses. Private industrial forest owners hold almost half of the productive timber land, covering approximately 29% of the basin (USFS 1994). Since 1991 there has most likely been an increase in the rate of timber harvest on private lands.

As of 1988, a quarter of industrial forestland was in the mature (trees of age 80-200 years) or old (trees older than 200 years) growth categories. These stands contain trees of sufficient size (>21 inches DBH) to contribute at present to large woody debris (LWD) in streams, which is important in the development of cover and habitat complexity (Cramer et al. 1997).

The potential of the South Fork McKenzie River watershed to contribute major volumes of large logs to the local economy is limited. Less than a quarter of the South Fork is currently available for timber production because of the large proportion in non-harvestable allocations such as Wilderness, Late Successional Reserves, and Riparian Reserves. On those lands that are harvestable, concentrated harvest has resulted in a high proportion of early and young stands (USFS 1994). It is likely that riparian habitat and stream conditions in the South Fork McKenzie River watershed will continue to improve into the foreseeable future.

RECREATION

A variety of recreational opportunities are available throughout the watershed. In particular, the corridor adjacent to the river in the South Fork watershed provides access to developed campgrounds and numerous dispersed campsites (USFS 1994). Recreationists make use of Cougar Reservoir for boating and fishing.

ODFW has reported that bull trout are regularly, but not commonly, caught by anglers fishing below Cougar Dam (Jeff Ziller, ODFW Springfield, personal communication). However, bull trout occurring in the watershed above and below Cougar Reservoir are somewhat protected from harvest by state fishing regulations.

Regulated fisheries for salmon, steelhead and trout also occur in the McKenzie River Basin. ODFW instituted a marked-fish-only (i.e., hatchery fish) harvest of spring chinook on the McKenzie River in 1995. ODFW has identified key spring chinook natural production areas within the McKenzie Basin, has developed plans for mass marking of hatchery fish, and has implemented more strict control of procedures affecting the genetic attributes of salmon reared at McKenzie Hatchery (Cramer et al. 1996). Consequently, it is unlikely that hatchery and regulated harvest programs within the McKenzie Subbasin will threaten the persistence of the listed species occurring there.

HYDROPOWER PRODUCTION

Spring chinook salmon in the McKenzie River have been impacted for many years by entrainment into unscreened power diversion canals owned and operated by the Eugene Water and Electric Board (EWEB), and by de-watering of the mainstem during EWEB's use of their canals. Recent operational changes have resulted in more water remaining in the mainstem to support fish and recreational use (USFS 1994).

As a part of its cooperative efforts under FERC relicensing considerations, EWEB began in 1992 to voluntarily provide significant increases in minimum flows to Leaburg and Walterville canal bypass reaches. Doubling of minimum flows (from about 500 cfs to 1,000 cfs) provided benefits to juvenile spring chinook rearing in 13 miles of stream below these projects through reduction in summer water temperatures (EWEB 1995) and through increases in wetted riffle and side-channel areas that are important for food production and rearing (EA 1991).

The Leaburg diversion was screened in 1985, and resulted in salmonid smolt survival rates exceeding 98%. Test results also indicated that fry survival was greater than 95% (Cramer et al. 1996). The Walterville diversion is scheduled for screening as a condition of the Federal Energy Regulatory Commission (FERC) relicensing agreement. Since 1984, EWEB has cooperated with ODFW to implement a program of canal flow reductions and strategic closures designed to protect emigrating juvenile salmonids (Cramer et al. 1996). Fish protection facilities and operations required as a result of FERC relicensing should address most or all of the negative impacts from hydropower production on resident and anadromous fishes produced in the McKenzie River Basin.

URBAN AND RURAL DEVELOPMENT

Riparian area fragmentation, placement of riprap revetment for flood protection, infrastructure development (e.g., roads), and water quality degradation, particularly from non-point sources and stormwater runoff, are problems associated with urban and rural development in the McKenzie River Basin (John Runyon, McKenzie River Watershed Council, personal communication). The McKenzie River Watershed Council is in the process of preparing a detailed analysis of these factors and their report should be available in about one year. They have developed an Action Plan that includes actions for long-term protection of water quality, actions for fish and wildlife habitat monitoring, recommendations for recreation and human habitat use within the watershed, and recommendations for watershed educational activities (Cramer et al. 1996).

SUMMARY OF CONCLUSIONS

Based on the above analyses, the Corps concludes that the proposed Cougar WTC project construction activities may affect, but are not likely to adversely affect bald eagle. Canada lynx will not be affected by the proposed actions. However, spring chinook salmon, bull trout and Northern spotted owl are likely to be adversely effected in the project area. As a result, the Corps requests formal consultation with NMFS and with USFWS regarding these species, along with accompanying Biological Opinions and incidental take permits.

We note that there is currently a relative abundance of juvenile bull trout (approximately 22,000 fry) being produced annually in the lower McKenzie River subpopulation. This population is being used to provide bull trout (2,975 fish in 1999) for re-introductions into other areas within the Willamette Basin, and provides a safety net with regard to the extirpation of bull trout above Cougar Dam. In contrast, there is a low likelihood of impacting more than a few bull trout as a result of implementing the proposed project. The Corps anticipates that implementation of protective measures for bull trout recommended by USFWS will result in impacts to bull trout that are likely to be insignificant or discountable.

Likewise, the McKenzie River Basin supports the strongest naturally producing component of spring chinook salmon in the Upper Willamette ESU. The Corps anticipates that an adequate monitoring program will result in minimizing potential impacts to spring chinook such that these impacts are likely to be insignificant or discountable.

MONITORING PLAN

Potential problems associated with implementation of the Cougar WTC project that might impact fish and wildlife resources and that are, therefore.

addressed in this Biological Assessment include accidental spill of fuel or other caustic chemicals, noise from blasting or operation of construction-related equipment, stranding of fish during reservoir drawdown, bank failure (i.e., landslides) in the reservoir area following drawdown, and lack of adequate water quality due to high water temperature or turbidity in the residual pool or in the South Fork McKenzie River downstream of Cougar Dam. Flooding, forest fires, seismic activity, disruptive human activity, or other unforeseen natural or anthropogenic events could also result in impacts to fish and wildlife resources that might be exacerbated as a result of implementing the Cougar WTC project. The following monitoring plan is intended to provide for detection and resolution, to the extent possible, of any problems that may develop as a result of these circumstances.

WATER QUALITY MONITORING

The Cougar WTC project is exempt from Section 401 Water Quality Certification requirements pursuant to Section 404(r) of the Federal Clean Water Act. However, the project must maintain state water quality standards (Tom Melville, ODEQ, personal communication).

Water quality monitoring that would occur during and following the construction period was initially described in the FDM (USACE 1998, page 7-3 & 7-4) and is described in more detail below. Flow, water temperature and turbidity of inflow above Cougar Dam and flow, water temperature, turbidity, and dissolved oxygen (DO) of discharge below the dam would be monitored on an hourly or daily basis at existing U.S. Geological Survey (USGS) gagging stations. This data would be directed via telemonitoring to an Internet web site where it would be readily available for real-time perusal.

In addition to stream monitoring, water temperature, DO, turbidity, and other parameters (percent oxygen saturation, pH, total dissolved solids, conductivity, and oxidation-reduction potential) would be measured using a Hydrolab® type instrument along vertical profiles (i.e., at one to five meter depth intervals, depending upon rate of change in parameters measured) in the residual pool above Cougar Dam on a weekly basis. Monitoring would be conducted at three or more sampling stations within the reservoir, presumably under a cooperative agreement with ODFW. At a minimum, sampling stations would be located near the dam, near the mouth of the East Fork McKenzie River, and in the upper end of the reservoir.

Problematic levels of DO have not been observed, historically, in the hypolimnion of Cougar Reservoir or as a result of discharges below Cougar Dam (USACE 1995). The high rate of exchange in water volume of the residual pool at elevation 1,375 feet NGVD in comparison to the normal reservoir volume at Minimum Flood Control Pool elevation of 1,532 feet NGVD would decrease the likelihood of depressed DO conditions at depth within the residual pool. The likelihood that depressed DO levels would occur below Cougar Dam during implementation of the proposed project is very low as a result of the high likely DO levels at depth in the residual pool and the agitated and turbulent conditions under which discharges would be made.

In general, flows discharged below Cougar Dam would be managed to equal inflows above the project up to a capacity flow volume of 1,200 cfs at pool elevation 1,375 feet NGVD. Water temperatures associated with these discharges are expected to be 3-6F? warmer than inflow water temperatures based on Corps modeling results (USACE 1995).

The Corps anticipates that only very fine colloidal material (i.e., clay), which would remain in suspension during transport downstream, would be discharged during the construction period. The Corps would work with ODFW to monitor the residual pool and downstream of Cougar Dam for distressed or dying fish (see “BIOLOGICAL MONITORING” below), unusual sediment deposition, or visible turbidity extending downstream to the mainstem McKenzie River. If any of these conditions were to occur, or if turbidity levels observed below Cougar Dam as a result of monitoring were to reach or exceed 25 mg/l (Newcombe and Jensen 1996), the Corps would investigate and document the cause of the problem. If it was discovered that activities or environmental conditions resulting from project construction activities were contributing substantially to the observed turbidity level or other problematic condition, the Corps would implement best management practices (BMPs) and would take all reasonable and prudent actions within its power to address the problematic conditions. Examples of BMPs that may apply are provided in Engineering Pamphlet 1110-1-16 (USACE 1997) and in “Recommended Best Management Practices for Storm Water Discharges” (ODEQ 1997). The Corps’s pamphlet is available on the Internet at http://www.usace.army.mil/inet/usace-docs.

Flow, water temperature and turbidity conditions at inflow to the residual pool would be compared to conditions in the residual pool and below the dam. A daily log of stream and reservoir conditions, including any storm events, would be maintained along with a database of the associated water quality parameters described above. Problem events would be reported by the Corps to Oregon Department of Environmental Quality (ODEQ), ODFW, NMFS, and USFWS, along with information about any corrective actions taken. Quarterly monitoring, annual progress, and final project reports regarding these conditions and actions would be prepared and distributed to agency representatives participating on the Cougar WTC project Environmental Coordination Task Force (ECTF). This task force would be comprised of representatives from pertinent state and federal regulatory agencies. It would be established by the Corps for the purpose of assisting the Corps in reviewing study and monitoring results, identifying needs for corrective action, formulating design and corrective action recommendations, assisting as needed with corrective action implementation, and assisting with providing information concerning the project to their constituencies and to the public. Initially, the ECTF would meet on a quarterly basis, or as needed to address project needs. Conference calling could be employed for addressing emergency situations, if needed.

Water quality monitoring of flow, temperature, and turbidity would continue following construction, along with system operations monitoring, to provide information needed for development of flow temperature management criteria and an associated operational protocol. The biological effectiveness of temperature control management would also be evaluated. Details of these monitoring and evaluation activities will be addressed in a separate BA.

BIOLOGICAL MONITORING

Unforeseen environmental (e.g., high discharge events, seismic events) or biological (e.g., unusual fish abundance) circumstances that might be influenced by construction activities could result in potential impacts to fish or other wildlife resources. Biological monitoring of fish and wildlife resources would be conducted to detect and address such circumstances where possible. The Cougar WTC project ECTF would serve as the central coordinating body for monitoring project activities and recommending to the Corps appropriate corrective actions that should be taken to protect fish and wildlife resources. The Corps would consider ECTF recommendations, and would formulate decisions regarding corrective actions to be taken in consultation with NMFS and USFWS.

Fisheries Resources

The Corps would work with ODFW to monitor drawdown of Cougar Reservoir and to monitor the residual pool and area below Cougar Dam for potential impacts of construction activities on bull trout, spring chinook salmon or other fish species. The Corps would work with ODFW to experimentally trap bull trout (and, possibly, spring chinook salmon) above, within, and below Cougar Reservoir during implementation of the Cougar WTC project (2000-2003). Experimental trapping would begin in 2000; one year before initial drawdown of Cougar Reservoir. Detailed annual study plans for this work would be developed cooperatively with ODFW and reviewed by representatives of the ECTF. Annual plans would be submitted by the Corps to USFWS and NMFS for approval. Nearly continuous experimental trapping of bull trout (and, possibly, spring chinook salmon) from above and below Cougar Dam, and relocation of bull trout either to temporary holding facilities or to release sites below Cougar Dam, would provide an opportunity for monitoring the response of fishes to Cougar WTC project activities, could reduce the vulnerability of bull trout to potential effects of the project, and would provide information needed for siting and design of permanent trap-and-haul facilities and for identification of alternative protective measures for bull trout that could be taken, if needed.

During the construction period each year (June through October), the Corps would periodically (e.g., biweekly) survey conditions in the residual pool and in the South Fork McKenzie River up to a mile (or some other appropriate distance) below Cougar Dam. Results of monitoring would be reported in quarterly monitoring, annual progress, and final project reports to the Corps and to the ECTF. If unusual mortality (e.g., other than normal post-spawning mortality) to spring chinook salmon, bull trout or other fish species was observed during periodic monitoring surveys, NMFS, USFWS and ODFW would be advised by the Corps; an attempt to determine causative factors would be initiated; and the results of the investigation would be documented. If those factors were associated with Cougar WTC project activities or related environmental conditions (e.g., an accidental spill or a landslide event in the reservoir area), the Corps or the Corps's contractor would implement BMPs and take whatever immediate corrective action it deemed necessary and appropriate to resolve the situation (e.g., spill containment measures or use of a silt fence around a slide area). The Corps would consult with and advise NMFS and USFWS accordingly.

If the need for, or appropriate type of, corrective action was uncertain, the Corps would ask NMFS, USFWS, and other members of the ECTF to formulate a judgement as to whether corrective action was warranted and, if so, to formulate recommendations as to the type of action that would be most appropriate. The Corps would consider these recommendations, and would continue to consult with NMFS and USFWS, in making a determination as to whether any reasonable and prudent corrective action could and would be taken.

Wildlife Resources

Suitable habitat for spotted owls within one mile of the project site will be annually surveyed, using established protocol, to determine occupancy and nesting activity. Noise levels will be monitored at a recording station, which will be located in the Rush Creek drainage, approximately 2,000 feet from the Rush Creek diversion tunnel intake and the Cougar Reservoir intake structure. Construction noise at the monitoring station will not be allowed to exceed 60 dBA. Noise during blasting will not exceed 90 dBC.

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